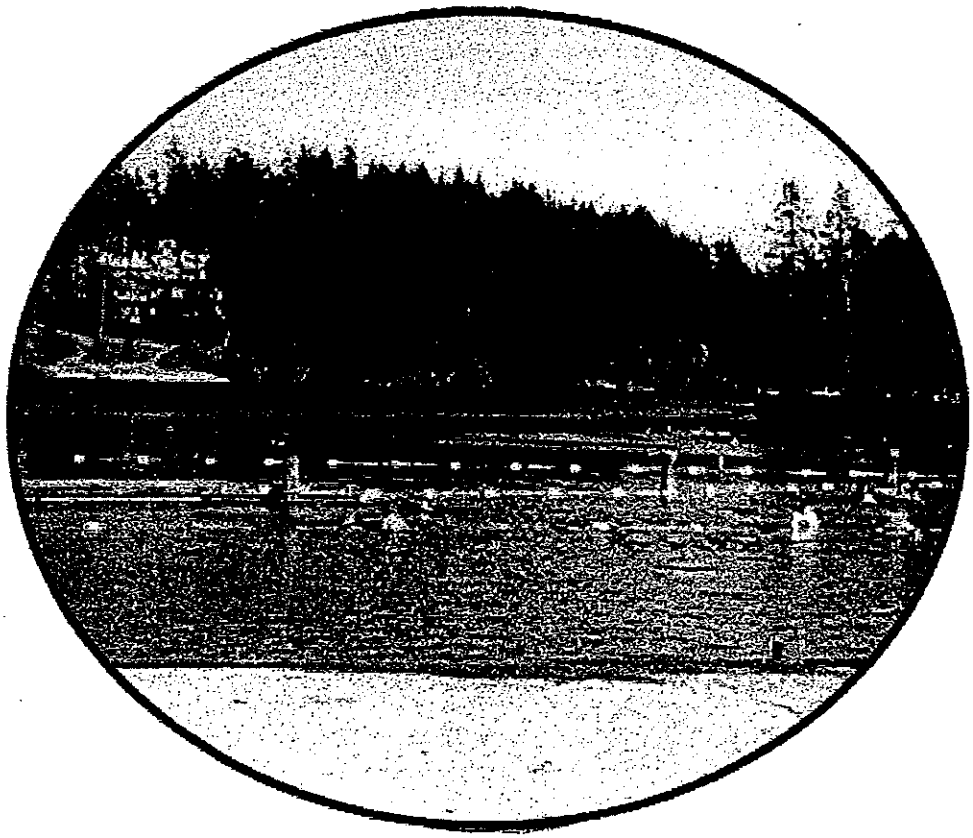
ILDERNESS
ATED AQUATIC PLANT MANAGEMENT PLAN

MAY 1997



ENVIROVISION

LAKE WILDERNESS
INTEGRATED AQUATIC PLANT MANAGEMENT PLAN

May 1997

FINAL

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Prepared for:

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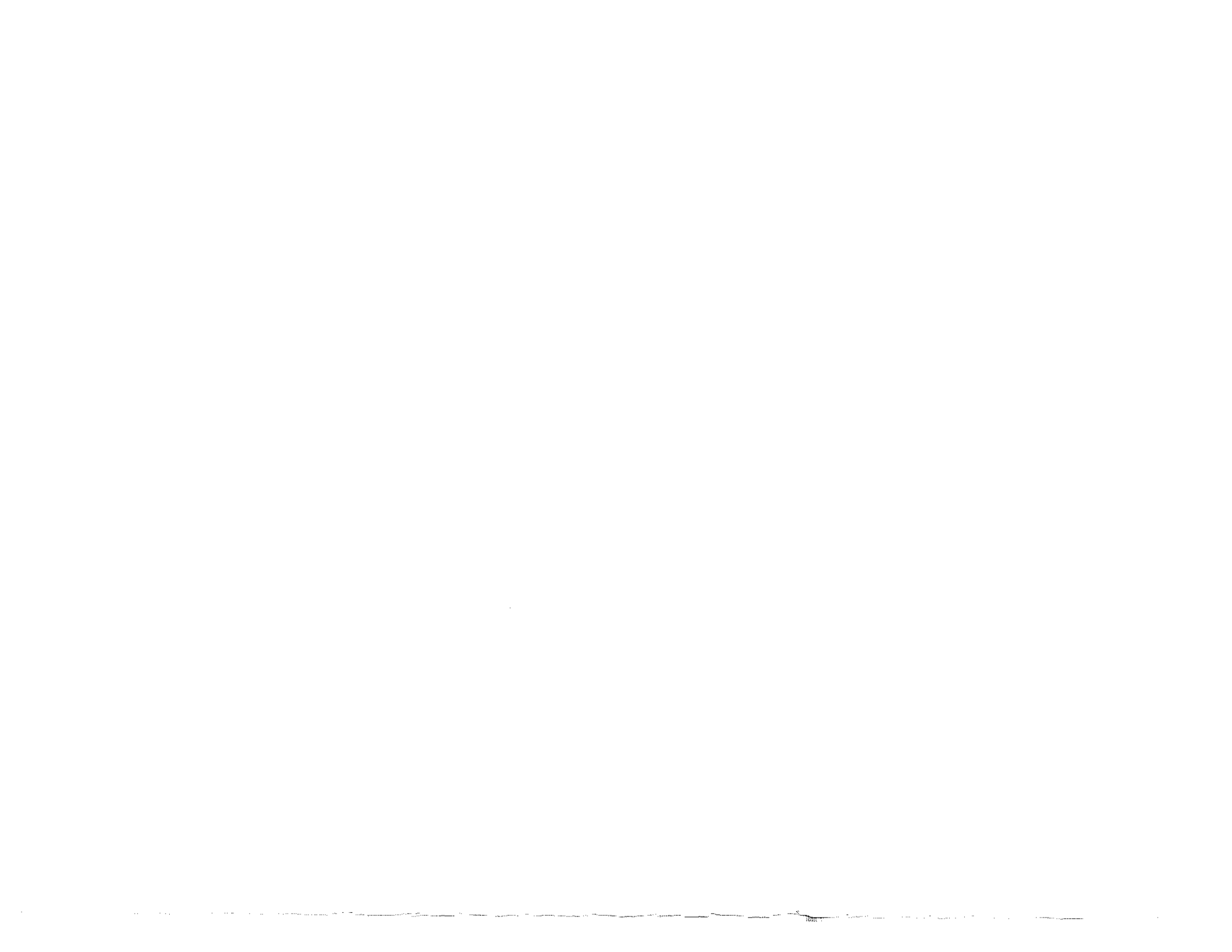

PROJECT OVERVIEW

Lake Wilderness is small lake (67 acres) located in southeast King County, within the newly incorporated City of Maple Valley. Total volume of the lake is 1,300 acre feet. The lake is relatively shallow with an average depth of 21 feet and a maximum depth of 38 feet. There are no permanent streams flowing into Lake Wilderness. Groundwater seeps, direct precipitation onto the lake surface, and stormwater runoff from the watershed are the only sources of incoming water. The surface water leaves the lake along the northwest shore via Jenkins Creek. The lake has a very popular County park and a State Fish and Wildlife boat launch along the western shore. There is a five acre private park along the eastern shoreline owned by Lake Forest Estates. Additionally, the County maintains a trail which runs along the eastern shoreline of the lake.

Presently the water quality in Lake Wilderness is characterized as good and it is rated as "mesotrophic" in terms of biological productivity and trophic state (King County 1996). However, the lake has had periodically high phosphorus levels possibly resulting from stormwater runoff (King County 1990). In January 1994 local residents formed the Lake Wilderness Preservation Association to preserve and protect the lakes' water quality and control aquatic plants. During an aquatic plant survey conducted by King County in the summer of 1994, the invasive aquatic plant Eurasian watermilfoil (*Myriophyllum spicatum*) was discovered for the first time in a few spots around the lake. In 1995 lake residents and King County Surface Water Management Division (King County 1996) joined together to apply for a grant to develop a plan for long-term control of aquatic plants, including Eurasian watermilfoil. King County was awarded a grant for development of an Integrated Aquatic Vegetation Management Plan (IAVMP). A survey conducted as part of this planning effort found Eurasian watermilfoil to have spread rapidly in the last two years. The invasive plant now can be found in most shallow areas, either as a monoculture or intermixed with native aquatic plants. To date, no herbicides have been used to control aquatic plants in the lake.

This report provides a description of the aquatic plant control plan developed for Lake Wilderness. The basic recommendations selected for aquatic plant control in Lake Wilderness are:

- A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil.
- Use of Aquathol® and bottom barrier for the long-term control of native submerged plants.
- Set up an Aquatic Plant Advisory Committee for the lake whose function is to make decisions annually about controls needed and review aquatic plant management goals.
- Establishment of conservancy zones for long-term protection of the aquatic habitat for fish and wildlife.

PUBLIC INVOLVEMENT

Public Involvement for this project has included steering committee meetings, and public meetings. Each element is described below.

A Lake Wilderness Steering Committee was organized in July 1996 to guide the development of an Integrated Aquatic Plant Management Plan for Lake Wilderness. Six meetings were held between July 1996 and April 1997. During this time the steering committee completed the problem statement, identified and developed management goals, organized the public meeting, selected aquatic plant control alternatives, and reviewed funding options.

A public meeting sponsored by the Lake Wilderness Steering Committee and the King County Surface Water Management Division was held on October 21, 1996. The purpose of the meeting was to provide background information about Lake Wilderness, present the problem statement and management goals drafted by the steering committee, and seek comments and questions from the public. A second public meeting was held in March 1997 to receive public comment on the draft plan. Appendix C contains a summary of the response to comments received during the meeting and through other means.

LAKE AND WATERSHED CHARACTERISTICS

Physical Characteristics

Lake Wilderness and its 420 acre watershed are located largely within the boundaries of the newly created City of Maple Valley (Figure 1). The lake has a surface area of 67 acres and a total lake volume of 1,300 acre-feet. The lake is relatively shallow with a mean and maximum depth of 21 feet and 38 feet, respectively. Physical characteristics of the lake are summarized in Table 1.

Watershed soils are primarily Vashon-age recessional outwash which are characterized by high (though variable) permeability and provide a direct hydraulic connection between surface water and the shallow aquifer (King County, 1990). Water enters Lake Wilderness via groundwater seeps, direct precipitation onto the lake, or stormwater runoff from the surrounding watershed. Lake Wilderness is the headwaters for Jenkins Creek. Water leaves the lake along the western shore into Jenkins Creek (tributary #0087).

Jenkins Creek is one of the main tributaries of Big Soos Creek. Portions of Jenkins Creek serve a significant rearing function for anadromous fish and provide excellent overall habitat for resident fish. Jenkins Creek immediately downstream of the lake had been piped and was often pumped dry to irrigate the Lake Wilderness Golf Course (King County, 1990). Restoration projects for Jenkins Creek in the area of the lake outflow were recommended as part of the Soos Creek Basin Plan to stabilize and revegetate streambanks, improve instream habitat diversity, and redirect runoff through water-quality pretreatment facilities before discharge to the creek (King County, 1990).

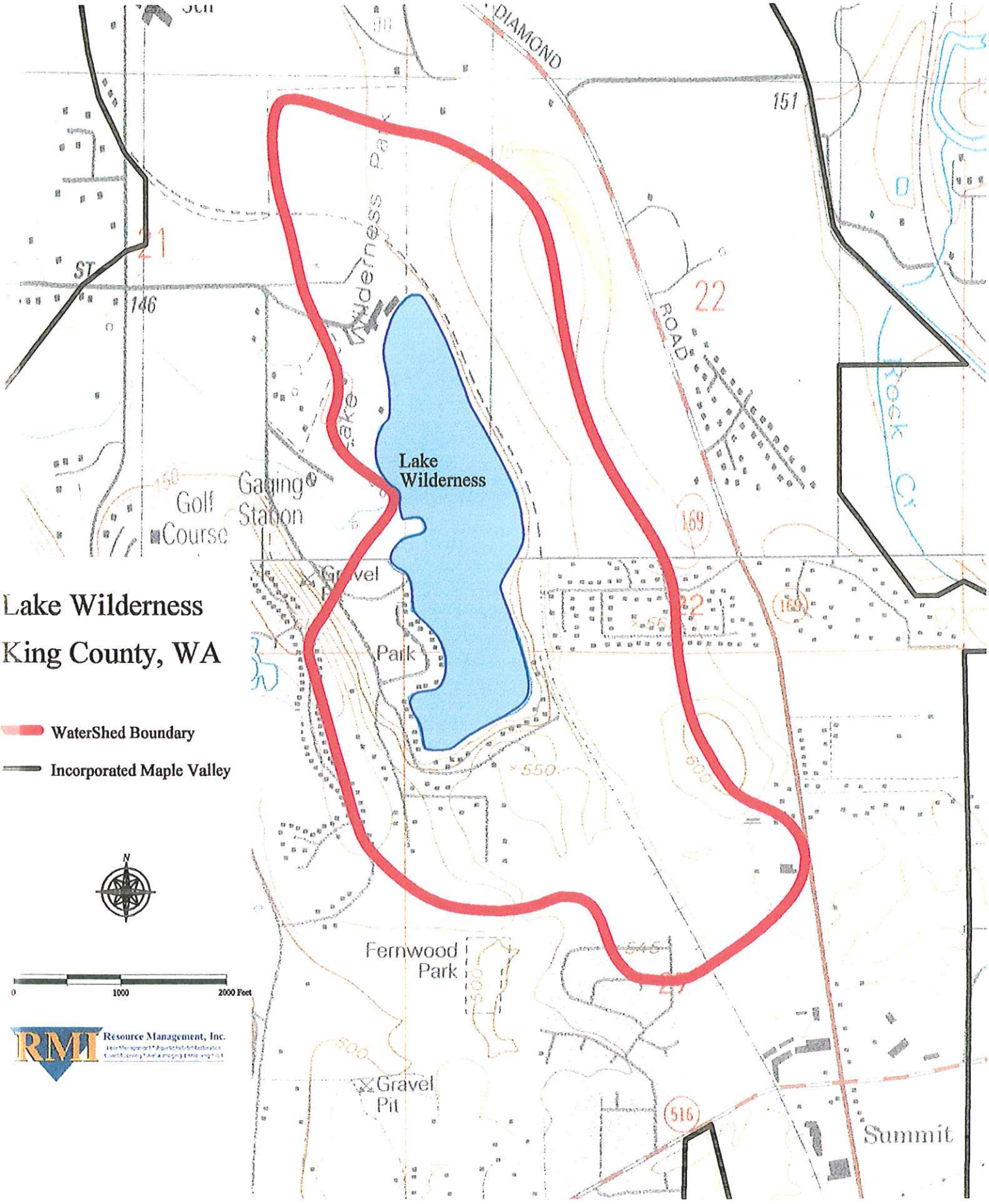

Figure 1. Watershed Boundary (approximate) for Lake Wilderness

Channel improvements have been made which re-establish stream habitat and allow for fish passage (King County, 1994).

A popular 108 acre Lake Wilderness County Park is located along the northwest shore. In 1987, ownership of a University of Washington Center for Continuing Education, which was located at the north end of the lake, was passed to the King County Parks Department. The County also maintains a trail along the eastside of the lake which merges with the Cedar River Trail system. Presently, King County owns roughly one third of the shoreline (Anderson, P., 21 January 1997, personal communication).

The Lake Wilderness watershed is part of the Soos Creek Basin. As of 1976, only 2 percent of the 420 acre watershed was developed for residential use (Metro, 1989). As with other areas of King County, urbanization is encroaching on the watershed. A 1985 land use survey of the area showed most of the watershed was still forested (King County 1994). Significant changes in land use can be expected in the project area in the future. As of December 1995, most of the watershed is zoned for four to six residential dwelling units per acre (Hanson, L., January 1997, personal communication). Additionally, Wilderness Village, a commercial and residential development, is in the planning stages for the north end of the lake. Fortunately, King County owns approximately one-third of the shoreline which is intended to be managed as permanent open space.

Public access is provided at numerous places along the shoreline, primarily through County owned property. There is a small boat launch owned by the Washington Department of Fish and Wildlife (WDFW) just south of the County park.

Table 1. Physical characteristics of Lake Wilderness and its watershed.

Characteristic	English Units	Metric Units
Watershed area	420 acres	170 hectares
Surface area	67 acres	27 hectares
Lake volume	1300 ac-ft	
Maximum depth	38 feet	11.6 meters
Mean depth	21 feet	6.4 meters
Shoreline length	9504 feet	2898 meters

Water Quality

"Eutrophication" is a term used to describe the physical, chemical, and biological changes associated with enrichment of a lake due to increases in nutrients and sediment over time. Although eutrophication can occur as a natural process that occurs slowly over time, it can be greatly accelerated by human activities in a watershed. Natural eutrophication processes occur on a time scale of hundreds to thousands of years and are generally not observable in a single human lifetime. Human induced or "cultural" eutrophication can result from activities within the

watershed including development, forestry, resource extraction (i.e., peat mining) landscaping, gardening, and animal keeping. All of these activities contribute nutrients and sediment to surface waters. Sediment inputs from watershed activities results in the slow filling in of lakes which also accelerates the overall eutrophication process. Cultural eutrophication can result in observable changes within a few decades, or less.

The most common way lakes are classified is by their trophic state, which defines a lake in relation to the degree of biological productivity. Lakes with low nutrients, low algae levels, and clear water are classified as nutrient poor or "oligotrophic". Lakes with high nutrients, high algae levels, and low water clarity are classified as nutrient rich or "eutrophic". "Mesotrophic" lakes have water quality characteristics between these two classifications.

Classifying a lake based on its trophic state is a useful way to describe changes in a lakes' water quality over time and assess the potential sensitivity of a specific lake to additional nutrient loading. Total phosphorus, chlorophyll *a*, and transparency are the three water quality parameters most often used to rate the overall trophic condition of a lake. Phosphorus is one of the essential nutrients for plant growth. Total phosphorus includes all soluble, organic, and particulate forms of phosphorus. Chlorophyll *a* is one of a family of green pigments that allows green plants to perform photosynthesis. Chlorophyll *a* concentration is a correlation with the abundance of algae in a lake. Water transparency is commonly measured as the depth at which a black-and-white disk (i.e., Secchi disk), when lowered into the water, ceases to be visible. Algal growth, organic acids, and suspended solids all influence Secchi depth transparency. Threshold values for trophic state are presented in Table 2.

Water quality data has been collected from Lake Wilderness since 1971. In 1971 - 1972, and 1974 - 1977, and 1982 - 1993, the former Municipality of Metropolitan Seattle (Metro) performed annual lake monitoring. (Metro 1989; King County 1996). As of 1994, King County Surface Water Management (King County) and Metro became a single government. This resulted in the former Metro becoming a department within King County. As of 1995 the lake volunteer monitoring program merged and was administered primarily by the King County Surface Water Management Division (which has now been reorganized into the Department of Natural Resources as the Water and Land Division beginning January 1997). The most recent complete data sets are contained in the *King County Lake Volunteer Monitoring Report 1993 - 1995*. These were used to create the data summary in Table 2.

Historically, Lake Wilderness has been classified as being mesotrophic (Metro 1989; King County 1996). Mean seasonal (May through October) chlorophyll *a* levels have generally fallen within the mesotrophic range and mean Secchi disk depths have often fallen in the oligotrophic range. However, mean total phosphorus concentrations have been consistently bordering on the mesotrophic - eutrophic threshold. The primary external source of these high phosphorus levels may be stormwater runoff (King County, 1990). Additional examination of water quality issues was beyond the scope of this project. The Lake Wilderness Preservation Association should continue their efforts of lake monitoring and stewardship actions to protect and address lake water quality.

Table 2. Trophic State Classification[1]

Trophic State	Total Phosphorus (µg/L)	Chlorophyll *a* (µg/L)	Transparency (meters)
Oligotrophic	< 10	< 4	> 4
Mesotrophic	10 - 20	4 - 10	2 - 4
Eutrophic	>20	>10	< 2
Wilderness (Range)[2]	11 - 105	0.6 - 21.2	2 - 6.5
Mean (1994/1995/1996)[3]	27 / 24/ 24	4.2 / 7.8/ 4.4	3.9 / 3.4/ 4.9

[1] *As modified from Gilliam, R.J. and G.C. Bortleson. 1983. Relationships between water quality and phosphorus concentrations for lakes of the Puget Sound region. U.S.G.S. open file report 83-255.*

[2] *Range shown is range of samples collected May through October in 1994, 1995, and 1996*

[3] *Mean shown is the May through October mean for each year indicated. Source of data is King County 1996; Walton, S., Personal Communication.*

Fish and wildlife community

The Washington Department of Fish and Wildlife (WDFW) has managed Lake Wilderness as a trout monoculture for many years. The lake has been chemically treated numerous times to remove competitive species. The last treatment occurred in 1988 to remove Pumpkinseed Sunfish (*Lepomis gibbosus*), Brown Bullhead Catfish (*Ictalurus melas*), Largemouth Bass (*Micropterus salmoides*) and Goldfish (*Carassius auratus*). Bass have since been illegally reintroduced and it is unknown if Sunfish, Bullheads, or Goldfish are currently present. (Pfeifer, R., 30 August 1996, personal communication).

The lake is stocked annually with catchable size Rainbow trout (Salmo gairdneri). Some hatchery broodstock culls have been added in recent years to offer some larger early-season catch. Rainbow fry introductions have been terminated since competitive species have reduced their survival to near zero. Kokanee fry were stocked through 1995, but have also been discontinued due to poor survival.

Estimates of total Opening Day angler trips and catch on Lake Wilderness (Table 3) indicate that trout abundance has declined in the last decade. The decline is due in part to the presence of competitive species and severe predation by the double-crested cormorant. Presently the lake is to be managed by default as a mixed species lake (Pfeifer, R., 30 August 1996, personal communication).

Table 3. Opening Day estimates of angler trips and catch on Lake Wilderness[1]

Year	Total Trips	Total Catch	Catch/Hr	Catch/Angler
1980	1,219	2,505	0.66	2.47
1987	381	343	0.15	0.90
1988	388	989	0.41	2.55
1990	---	---	1.40	5.56
1991	---	---	1.74	6.52
1992	---	---	0.61	2.88
1993	262	150	0.10	0.57
1994	329	964	0.86	2.93
1995	277	286	0.23	1.03
1996	227	461	0.56	2.03

[1] *Source: Pfeifer, R. 1996.*

Aquatic Plant Community

Plant Survey

The aquatic plant community was surveyed on August 13, 1996 to document plant coverage. Differential global positioning equipment was used to log sampling locations. Divers established transect lines perpendicular to the shoreline with starting points placed uniformly around the shoreline at 200 foot intervals. Additional transects were chosen on the basis of degree of upland slope, curvature of the shoreline, presence or lack of shoreline development, shoreline use (i.e., boat access), and location of inlet and outlet streams. Using a measured polychain line, divers surveyed the lake bottom at five foot intervals and data was radio transmitted back to the boat. Detailed plant composition was recorded. Density and coverage was estimated by divers. Divers also scanned the areas between transects to improve survey accuracy.

Representative samples of all aquatic macrophytes and floating leafed plants found during the aquatic plant surveys of Lake Wilderness were collected, pressed and mounted. These specimens are currently stored at the office of the King County Water and Land Division.

Plant Characterization

The plant growth distribution in Lake Wilderness is illustrated in Figure 2. Roughly 50 percent of the total surface area (29 acres out of 67) of Lake Wilderness is covered with submerged aquatic plant growth and one third of an acre is covered with floating and emergent plants. The major vegetation pattern in Lake Wilderness can generally be divided into three depth zones. A mixed native macrophyte community exists to a depth of three feet. Next, a zone of Eurasian watermilfoil (*Myriophyllum spicatum*)

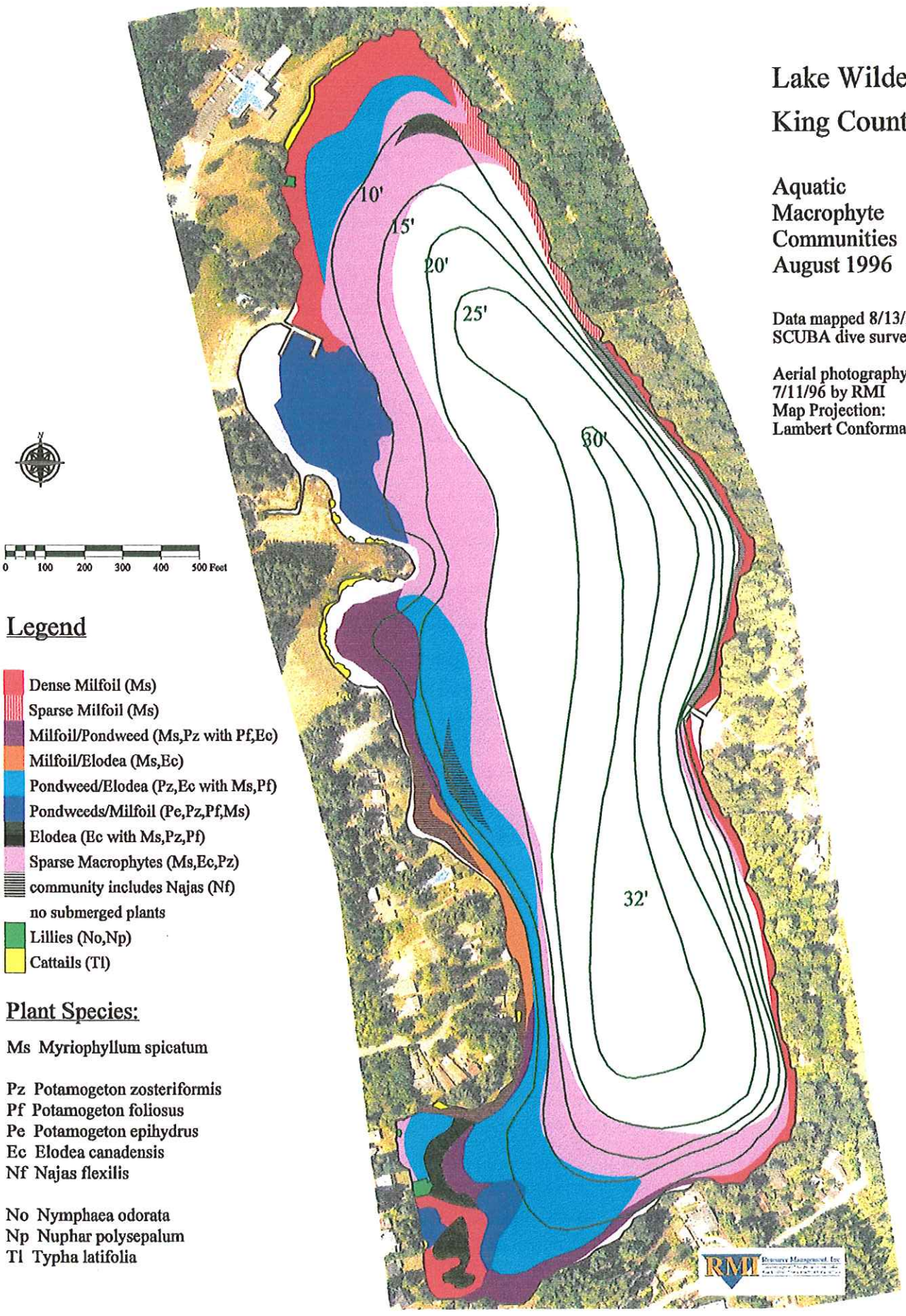

Figure 2. Lake Wilderness Aquatic Plant Communities, 1996

extends to a ten foot depth. A third zone of mixed native plants extends to a depth of 16 feet. No macroalgae or plant growth was noted below 16 feet.

The shallow grade along the north, south and west shores of Lake Wilderness provide an expansive shallow region to support plant growth. Shoreline development has likely contributed to increased macrophyte growth in this region through the introduction of nonpoint sources of nutrients (i.e., fertilizers and sediment deposition). The eastern shore of Lake Wilderness is steeply sloped with a littoral zone limited to a narrow band which extends approximately 60 feet from the shoreline. Healthy stands of pine trees along the east shoreline have helped maintained upland slope stability. The macrophyte communities along this shore typically have low plant densities. Plant growth along the eastern shore may be limited by shading and by the substrate in this region which is rocky with much wood debris.

Previous aquatic plant surveys were conducted in 1976, 1978, 1989, and 1994 by King County Staff (King County 1996). In 1976, *Potamogeton pusillus* and *Elodea canadensis* were noted as the dominant plants in the lake. In 1980, *Potamogeton pusillus*, *Elodea canadensis*, and *Najas flexis* were the dominant species. Eurasian watermilfoil was not found in the lake until the 1994 survey. At that time, Eurasian watermilfoil dominated much of the submergent plant community, particularly around the north end of the lake and around the swimming beach maintained by King County Parks.

The 1996 survey results indicate that a healthy variety of native plants inhabit the lake, but the exotic Eurasian watermilfoil appears to be increasing in coverage since it was first discovered in 1994 and is now dominating the eastern littoral region. Eurasian watermilfoil was found in monotype and mixed communities throughout the lake and to some degree can be found within nearly all of the 29 acres covered with aquatic plants. Along the northern shore roughly four acres are covered with dense Eurasian watermilfoil growth. Another 17 acres of the lake is comprised of a mix of Eurasian watermilfoil and native plants. Several native plants such as *Potamogeton foliosus*, *P. epihydrous*, *P. zosteriformis*, and *Elodea canadensis* have maintained dominance along the western shore. Within the 17 acres where Eurasian watermilfoil is mixed with *Elodea* and *Potamogeton* species, it could quickly take over dominance of this community.

The steep slopes, residential development, and high use areas which characterize the shore of Lake Wilderness has limited wetland plant communities around the lake. Several areas support stands of cattails, but other wetland and emergent plant species are scarce.

Characteristic Use

During development of this plan the steering committee was asked to develop a list of beneficial uses the lake provides and identify where those uses occur. Beneficial uses identified included; swimming, boating, fishing, hiking, wildlife viewing, and fish and wildlife habitat. WDFW provides a boat launch just south of the County Park. It should be noted that boating includes electric motors but internal combustion engines are no

longer allowed on the lake. The County Park includes a heavily utilized recreation area. The County maintains a 3.9 mile trail system along the eastern shore which merges with the Cedar River Trail to the north. The extensive trail system allows for hiking, wildlife viewing, and access to the lake. Public swimming is concentrated near the designated swim area at the County Park. On the east shore, a 5 acre private community park also provides a swimming beach. The point of land south of the County Park that juts out from the western shoreline is another popular swimming area. Swimming also occurs near private property but these areas have been impacted by dense plant growth. Some of the wildlife that utilize the lake include salmon, hawks, bald eagles, otters, heron, and cormorants.

PROBLEM STATEMENT FOR LAKE WILDERNESS

The following list of aquatic plant related problems was developed by the Lake Wilderness steering committee.

- The lake has lost its aesthetic value. Property values have decreased and there is a long-term public financial and recreational loss.
- The dense aquatic plants pose a safety hazard to swimmers who might get entangled in the vegetation or may be forced to swim further from shore to avoid them.
- Tall grass, cattails, and other growth along the shore limits shoreline fishing and is a safety concern for small children.
- Aquatic plants restrict the portion of the lake where people can fish. It is no longer possible to troll through most of the lake. Plants foul fishing gear, motors, and oars.
- There are suspected water quality impacts from the plants.
- The aquatic plants cause maintenance problems for the park, especially at the beginning of the season (i.e., plants need to be hand pulled from the shallow swimming area). Additionally, the deep swimming area is no longer useable due to dense plant growth.

The list of problems was used to create a problem statement for Lake Wilderness. The purpose of the problem statement is to describe as clearly as possible how the lake and its inhabitants are being negatively impacted by aquatic plants. The following problem statement was developed for the lake:

Lake Wilderness was once an aesthetic, pristine lake that provided important wildlife habitat, and offered many recreational opportunities, including; swimming, fishing, boating, and shoreline related activities. The lake supports one of the most popular parks in the King County park system. Beneficial uses of the lake have been severely impacted during the past 10 years from dense, prolific growth of aquatic plants.

The shallow shoreline area provides an excellent habitat for aquatic plants. In the past few years the aggressive, non-native plant Eurasian watermilfoil (Myriophyllum spicatum) has invaded the lake and is colonizing much of the shoreline habitat. The tall

and dense growing nature of this plant has caused an excessive deterioration in the quality of the lake and its value to the community. Even before the introduction of Eurasian watermilfoil, the lake was affected by dense stands of native aquatic plants. Unfortunately, these plants grow at their densest in the nearshore zone which is also the portion of the lake that is valued and utilized most by lake residents and visitors. The lake community is concerned about the loss of recreational use of the lake, the long term deterioration in water quality the plants will cause, the safety hazard the plants present to swimmers and boaters, and the commensurate loss in property values.

AQUATIC PLANT MANAGEMENT GOALS

The final step before beginning development of a plant control plan was to define goals against which the plan could be evaluated. Setting project goals is an important step because they are used to determine what control strategies will work, and will ultimately be used to evaluate whether plan implementation has been a success. The following list of management goals for Lake Wilderness was developed by the steering committee. A group rating process was used to rank the priority goals for plant control. The process resulted in the following priority goals.

- Develop a long-term plan for controlling plants and protecting water quality.
- Remove all invasive aquatic plants, (including Eurasian watermilfoil) and native species that cause nuisance conditions with the objective of recovering the lakes open water conditions for fishing and swimming.
- Develop a diverse and healthy balance of native plant communities and maintain them at a level that supports lakeside resident needs as well as benefits fish and wildlife.
- Develop an educational program that promotes lake and watershed stewardship and provides a greater awareness of the continual threat of noxious weeds and the importance of homeowner Best Management Practices (BMPs) for the long-term protection of Lake Wilderness.

AQUATIC PLANT MANAGEMENT OPTIONS

There are two areas of concern associated with the aquatic plant community in Lake Wilderness; Eurasian watermilfoil eradication, and the long-term control of native plants. All control alternatives described and approved by Ecology (1994) were considered for use in Lake Wilderness. These included the use of various herbicides, mechanical removal or harvesting, sediment dredging, stocking Grass Carp, and other techniques. Appendix A provides information on the most feasible methods that were presented to the steering committee as possible strategies. The process for selection of the preferred control option(s) began with presenting to the steering committee the entire range of control alternatives available and describing the advantages and

disadvantages of each and how each might best be utilized on Lake Wilderness. The next step was then to combine these control alternatives to form different strategies that met some or all aquatic plant management goals. Five control strategies were presented to the Lake Wilderness steering committee for consideration in selecting a recommended action plan. These scenarios involved the following combination of techniques:

- A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, and harvesting for the long-term control of submerged native plants
- A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, and the use of Aquathol® for the long-term control of submerged native plants
- A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, and dredging of the lake for the long-term control of submerged native plants
- Stocking of the lake with Grass Carp for long-term control of both Eurasian watermilfoil and submerged native plants
- A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, followed by the stocking of the lake with Grass Carp for the long-term control of native plants.

The second strategy listed (Sonar® treatment followed by annual treatments with Aquathol®), was eventually selected by the steering committee as the preferred strategy. Initially there was some concern expressed about the use of chemicals in an aquatic environment. Discussions of the toxicity of the selected herbicides and the herbicide approval process helped to alleviate some of these concerns. The following summary of the herbicide approval process is provided for clarification.

To be approved for use in aquatic environments, a herbicide must pass stringent toxicity testing by the federal government. These tests are designed to assess impacts to the target population (plants) as well as non-target populations such as fish, aquatic insects, and other organisms. The tests also examine what happens to the chemical over the long term to insure the chemical quickly breaks down into a non-toxic form and that, for example, it does not accumulate in sediments or fish tissue. Washington State has in turn set even more stringent standards. Therefore, many of the aquatic herbicides approved for use by the federal government are not approved for use in the state. The very low toxicity of both Sonar® and Aquathol® warranted their acceptance as two of the handful of aquatic herbicides allowed for use in Washington State. There are use restrictions for each which are described in the following sections.

RECOMMENDED AQUATIC PLANT CONTROL PLAN

Immediate Control Strategy (Watermilfoil Eradication)

At Lake Wilderness, Eurasian watermilfoil is concentrated throughout the lake. Once Eurasian watermilfoil has infested a lake it will continue to proliferate until it becomes

the dominant submerged plant. A herbicide treatment was chosen for the preferred method for Eurasian watermilfoil eradication. Fluridone, formulated as Sonar® for aquatic application, was chosen as the preferred herbicide because of its effectiveness in other Washington State lakes, its specificity for Eurasian watermilfoil, and its relatively long duration of control.

The application strategy for Sonar® requires that the entire lake is initially treated with enough of the chemical to reach an in-lake concentration of 20 parts per billion (ppb) and that a concentration of 10 to 20 ppb is held within the lake for at least a six week period. This requires close monitoring of the lake, and additional herbicide applications every two weeks. Sonar® when applied in this fashion has been proven to be highly effective in eliminating Eurasian watermilfoil.

Cost for the treatment, including the initial and follow-up applications, has been estimated at $80,000 (McNabb, T., November 1996, personal communication). Because the purpose of the Sonar® treatment is to eliminate Eurasian watermilfoil from the system, follow up diver surveys should be scheduled for at least the following three years to insure any remaining plants are quickly removed before they can again colonize the entire lake. A cost of $2,000 per year for the first three years, has been included in final cost estimates to cover the diver surveys. The Sonar® application should also include setting aside contingency money to remove any new infestations found during the surveys. A contingency fund of $5,000 per year for four years, should be collected and set aside to allow for this. Contingency actions (and associated costs) will be dependent upon the extent and location of infestations. A few plants spread out over a small area can be hand pulled by divers. Larger infestations that are found in one or two areas may be best controlled by bottom barrier, while larger areas that are spread out through the lake may require spot treatments with Sonar® in pellet form (Sonar® SRP) or another chemical if others become approved for use in Washington State (e.g. Trichlopyr). The total cost for the Sonar® treatment including follow-up dives and contingency funds is estimated at $106,000 over 10 years (Table 4), or $10,600 per year if averaged over a 10 year period. (Note: The cost for Sonar® has been steadily increasing and may be expected to continue to rise, therefore these estimates are approximate.) A short-term water quality modification permit from WDOE is required for aquatic herbicide applications.

Sonar® Use Considerations

Sonar® is a systemic herbicide which means it is effectively adsorbed by plants and translocated by both roots and shoots. It then inhibits carotenoid synthesis, killing the plant. Effects of Sonar® treatment become noticeable within 7 to 10 days of application, with complete control often requiring 60 to 90 days. This herbicide is considered to have very low toxicity to humans and aquatic organisms and comes with no swimming or fishing use restrictions. The only water use restriction for Sonar® applications is a "precaution" against using the water for irrigation. It recommended that treated water should not be used for irrigation of turf or plants for a period of 14 days. Sonar® also impacts submerged plant species other than Eurasian watermilfoil, however due to physiological differences between them, native plants are generally less affected and recolonize treated areas by the following year. Other than the chemical use concerns described previously, the primary drawback of Sonar® use is the

cost and possible water quality impact from the release of nutrients by decaying vegetation. (Appendix B contains a fact sheet developed by the Washington State Department of Health, Office of Toxic Substances, that provides more detailed information on this product.)

Long-Term Plant Control Strategy

The establishment of conservancy zones and a combination of bottom barriers and Aquathol® was selected for long-term management of submerged aquatic plants in Lake Wilderness. In general, approximately 10 acres of plants will be preserved as conservancy area, an estimated 0.2 acres will utilize bottom barrier, 5.8 acres will receive no active management, and approximately 13 acres of submerged plants will be treated annually with Aquathol®. WDFW has set guidelines that limit the amount of aquatic vegetation that can be removed from a lake to 40 percent. Control of the entire 13.2 acres as delineated in Figure 3, would actually result in removal of close to 46 percent of the plants. It must be clarified that the map and area estimates are provided to designate the approximate control zones only. Within the herbicide treatment zone, the area targeted for actual plant control would be determined each year. This annual determination would insure that the 40 percent WDFW guideline is met as well as avoid unnecessary treatment.

Conservancy Zone Designation

Figure 3, indicates the selected treatment areas in Lake Wilderness. Since much of the northern and eastern shoreline of the lake consists of King County park property, and/or does not have homes directly on the shore, and because this steep shoreline has only a narrow band of aquatic plants, much of the area was selected for preservation as a conservancy zone. This represents approximately 10 acres of aquatic plants. (Note that the whole lake Sonar® treatment described previously would apply to this area, so that the milfoil contained within this zone would be eliminated. The designation as Conservancy Zone applies to how native plants are treated over the long term.) As a conservancy zone, this portion of the lake would be left in its natural state and aquatic plants would be left to provide important fish and wildlife habitat. There are two possible future changes to the conservancy zone. A site just north of the existing King County Parks swimming beach, and a site south of the community swimming beach established on the eastern shoreline, have been identified as potential future swimming beaches. If these are developed as swimming areas, some aquatic plant control would be allowed. These areas are also depicted in Figure 3. There are no costs associated with establishment of conservancy zones.

Bottom Barrier Use

Bottom barrier has been selected for use in parts of the King County swimming beach and the community swimming beach located along the eastern shoreline (Figure 3). Bottom barriers are manufactured sheets of material that are anchored to the lake bottom to prevent plants from growing; similar to weed barriers commonly used in lawn and garden activities. Several bottom covering materials have been used with varying degrees of success. A woven polyester material such as Texel® is one of the most

effective bottom barriers because it is durable and it provides efficient exchange of gas produced from decaying organic matter (roots and other debris). It is typically installed in the winter by unrolling the 15 foot wide sections to the specified length and anchoring them with sand bags spaced 10 feet apart. Bottom barriers should be maintained on an annual basis to ensure adequate coverage and anchoring. Re-installation may be necessary to control encroachment of plants in areas adjacent to dense growth.

Bottom barriers are effective in deep as well as shallow water and do not have special requirements that eliminate their use in different areas. Control intensity and duration varies depending upon sediment accumulation and encroachment from adjacent area. If properly installed and maintained, bottom barriers can provide a high level of control for five years or more. The primary advantage of bottom barriers is the intense level of control and the ability to be very selective about the control area. The main disadvantage is the high cost per unit area controlled.

Assuming 6,000 square feet (60' x 100') of material is used in the County park and 3,000 square feet (30' x 100') is used at the community beach, and assuming a maximum unit cost of $1.00 per square foot installed, it would cost approximately $9,000 to install bottom barrier in the designated areas. Annual maintenance will improve the lifespan and effectiveness of the barriers. An annual maintenance cost of $1,000 has been included in the implementation cost estimates. The barriers would not be required during the first year when Sonar® is used to eliminate the milfoil. It is assumed they would be installed during the second year of plan implementation and replaced every five years after that. Therefore, the 10 year cost as shown in Table 4 is estimated at $25,000. Use of bottom barriers requires an Hydraulic Project Approval (HPA) permit from WDFW and a shoreline permit from King County.

Annual Aquatic Plant Control

The last part of the long-term plan consists of using the herbicide Aquathol® to provide annual control of plants. The application area for Aquathol® is shown in Figure 3, and represents approximately 12.2 acres of submerged plants in the main control area and an additional .75 acres of control to open a boat lane at the boat launch site (Figure 3). (The swimming beach access point(s) along the eastern shoreline may also be added to the Aquathol treatment zone at a later date, depending upon either the effectiveness of the barrier or changes in the plant community. It is the intention of this plan to allow flexibility for small changes to the treatment zone as long as WDFW guidelines for removing no more than 40 percent of the plant habitat continue to be met.) Application of the Aquathol® should be scheduled to achieve the greatest control (to maximize the amount of biomass treated and minimize the period for regrowth) while minimizing the impact on lake use. A mid- to late June application date should be targeted.

Unit costs for an Aquathol® treatment range from $610 to $775 per acre for submerged plant control, depending on chemical costs. An annual cost of $10,000 has been estimated for each treatment. This cost includes both materials (chemical) and labor (application). Additionally, permit costs associated with removal of native plant species

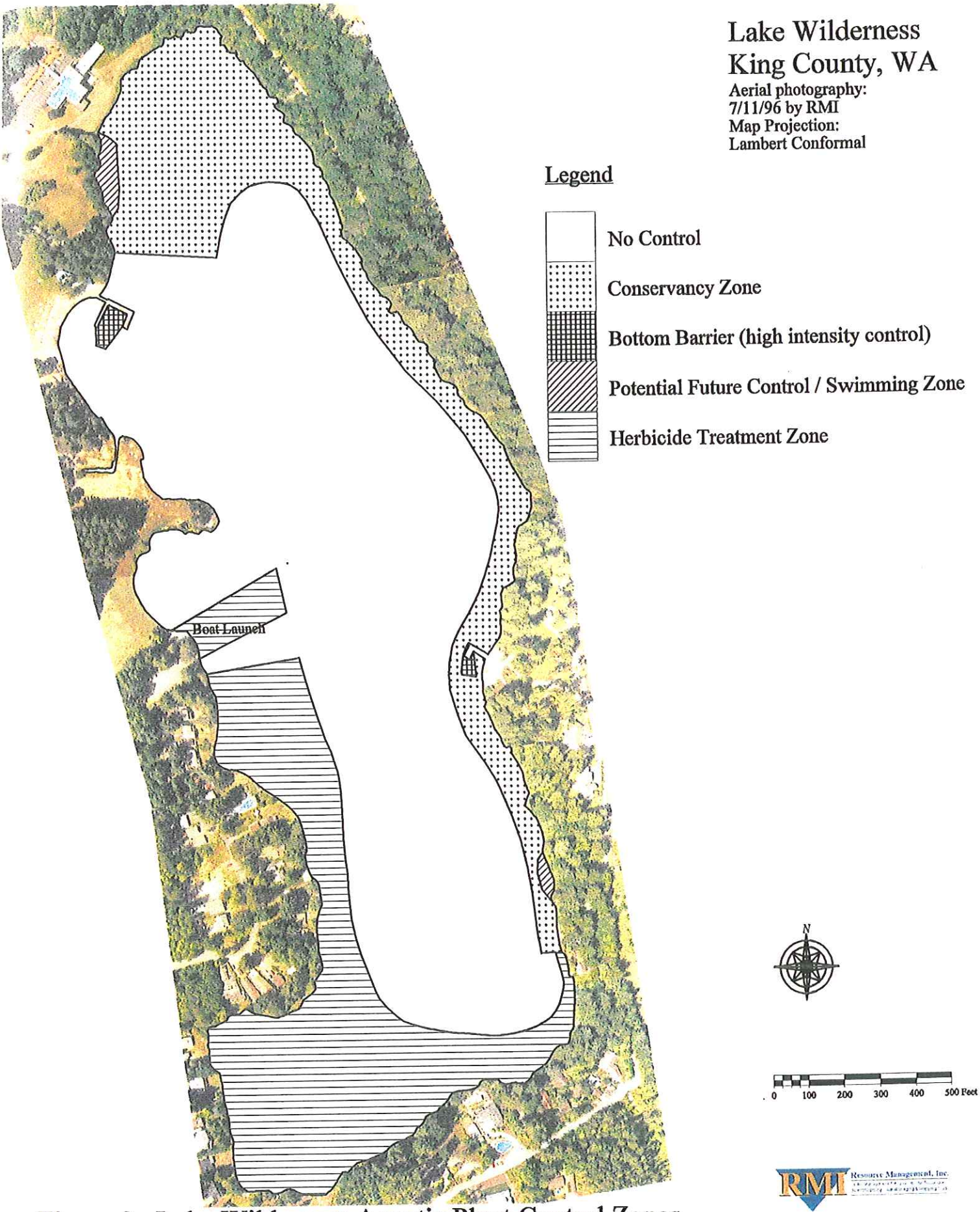

Figure 3. Lake Wilderness Aquatic Plant Control Zones

within a sensitive area will add approximately $1,300 to treatment costs. Therefore the estimated maximum annual cost for the treatment including the permit costs would be $11,300, with a 10 year cost of $101,700. Due to carry over affects from the Sonar® treatment, Aquathol® would not be required during the year of Sonar® treatment and possibly for the following year. (The cost summary included in this report (Table 4) assumes a treatment in the second year, and a maximum unit cost ($775/acre) to provide a conservative estimate of costs.) Use of aquatic herbicides requires a short-term water quality modification permit from WDOE.

Aquathol® Use Considerations

Aquathol® is a contact herbicide that affects many types of plants but does not impact the root system. This means it does not kill plants entirely, but "knocks them back" for the year. Because of this, annual applications are required to achieve long-term control of nuisance communities. Aquathol® has a number of use restrictions for treated waters. The Federal label on this product places no restriction on the use of treated waters for swimming, but has a 3 day fish consumption restriction on fish caught in the treatment area, and a 7 to 21 day restriction on irrigation or water supply use that is dependent upon application rate. In Washington State, there are additional restrictions: applicators must post a swimming restriction of 8 days, a 3 day fish consumption restriction, and a 35 day irrigation or portable water use restriction. These restrictions apply to all area within 400 feet of the application zone. (Appendix B contains a fact sheet developed by the Washington State Department of Health, Office of Toxic Substances, that provides more detailed information on this product.)

One of the benefits to using Aquathol® is that it can be used to "spot treat" specific areas, thereby keeping the costs lower relative to whole-lake herbicide treatments. As with most chemicals, one of the advantages of their use is the relatively immediate control; aquatic plants can be expected to die back within 7 to 14 days. The main disadvantage of using Aquathol®, other than general concerns always associated with the use of chemicals in aquatic environments, is that it can be expensive and requires an annual effort to maintain aquatic plant control.

A last note, Aquathol® was selected as the herbicide for long-term control due to its effectiveness, low toxicity and cost. If another herbicide is approved for use in Washington State that has similar attributes, it can be substituted assuming approval by the regulating agency.

Invasive Plant Prevention and Detection Program

The use of herbicide treatments in Lake Wilderness will effectively eliminate Eurasian watermilfoil from the lake for the time being. However, this plant could return to the lake from the introduction of Eurasian watermilfoil fragments. Other non-native, highly invasive plants of concern include; Parrotfeather (*Myriophyllum aquaticum*), Brazilian Elodea (*Egeria densa*), Hydrilla (*Hydrilla verticillata*), Fanwort (*Cabomba caroliniana*), and Water Hyacinth (*Eichhornia crassipes*). The focus of control efforts for non-native plants is a prevention and detection program. A contingency plan is also presented in case control of a large area is required.

To be effective this program should include both a source control component and a detection program. The objective of source control is to prevent non-native submerged plants entering the lake. In addition to the threats posed by Eurasian watermilfoil and Brazilian Elodea, two now common non-native submerged plants, there is the more serious threat associated with the discovery of Hydrilla sp. in nearby Lakes Lucerne and Pipe.

The public boat launch represents an area where there is a high potential for introduction or re-introduction of invasive plants. The addition of a boat and trailer wash facility is sometimes recommended to enhance plant fragment removal. However, these can be expensive to install since they require a water supply (well and pump), drainage facilities and possible a holding tank to keep the wash water and associated pollutants (plant fragments, heavy metals, oils, etc.) from entering the lake or stream, and they require continual oversight and maintenance. Furthermore, it is difficult to regulate their use and therefore their effectiveness is questionable. At a minimum, existing signage at the boat launch warning about milfoil and exotic plant introductions should be enhanced with specific instructions on how to clean boats and trailers.

Lake residents should also receive informative brochures on an annual basis reminding them of plant invasion problems and the importance of keeping their own equipment free of plants. It is also recommended that the lake community institute some public information campaign for opening day of the fishing season and a few other key weekends. Simply having volunteers hand out exotic plant identification cards for a few hours and help with boat and trailer checks will emphasize the importance of the effort and remind boaters of their responsibility to check equipment.

Early detection is the next step to protect against new infestations. While an infestation is still relatively small there are options for control that are much less expensive than the whole lake treatment methods required at this point. Early detection if done properly, requires both a trained group of lake volunteers who are responsible for occasional patrol of the lake, and periodic (bi-annual) diver surveys to assess the plant community. The main purpose of these surveys is to search for Eurasian watermilfoil and any other exotic plants. However, it will also provide a means for monitoring the native submerged plant community and determining where future control efforts should be focused. Volunteers would be trained each year in plant identification and survey techniques and each would be given the responsibility for surveying a certain section of shoreline once a month during the growing season. Their purpose would be to note any substantial changes in the plant community and to look for new invasions of nuisance species. Professional divers would perform a more complete survey every other year. (While divers are surveying the lake they can determine whether new infestations can be handled by handpulling the plants or whether, for example, bottom barrier should be installed in a few places to ensure complete control.)

The primary advantage of controlling small infestations is that it reduces the chance that a large area would need to be controlled by a more intensive and expensive technique. A drawback of controlling small infestations are the high costs associated with diver surveys and hand pulling. A professional diver survey of the entire plant habitat would take approximately 1 day and cost approximately $2,000. (Costs for hand pulling by contract divers range from $500 to $2,400 per day depending upon

Table 4. Estimated cost for implementation of the Lake Wilderness Aquatic Plant Control plan.

TASK	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	10 YEAR TOTAL
Milfoil Elimination											
Sonar® Treatment	$80,000										$80,000
Diver Surveys		$2,000	$2,000	$2,000							$6,000
Contingency		$5,000	$5,000	$5,000	$5,000						$20,000
Bottom Barrier											
Installation		$9,000					$9,000				$18,000
Maintenance			$1,000	$1,000	$1,000	$1,000		$1,000	$1,000	$1,000	$7,000
Aquathol®											
Treatment		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$90,000
Permit		$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$11,700
Invasive Plant Program											
Diver Surveys						$2,000		$2,000		$2,000	$6,000
Volunteer Surveys		$1,500									$1,500
Public Education											
Brochures/ Newsletter	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$12,500
TOTAL COST	**$81,250**	**$39,050**	**$20,550**	**$20,550**	**$18,550**	**$15,550**	**$21,550**	**$15,550**	**$13,550**	**$15,550**	**$252,700[1]**

[1] *Assuming an inflation rate of 3% to 5% each year, the 10 year total could range from approximately $293,000 to $314,000.*

plant type, acreage, and density.) Although the volunteer survey program should have no long-term cost, a training workshop would be necessary the first year. A volunteer training workshop cost of $1,500 has been included in plan implementation cost estimates.

The exotic plant control plan complements the plan for the eradication of Eurasian watermilfoil. The surveys that occur every two years would be relied upon to detect new infestations of Eurasian watermilfoil and allow immediate removal of the plants. If Eurasian watermilfoil or another exotic is found, immediate action should be taken and a second dive should be planned for later in the same year to insure there were no surviving colonies. If the area infested is too large to control by handpulling, or if after two follow-up dives the exotic is still found, bottom barriers would be placed in all areas where the plant was detected. Treatment with herbicide is recommended as a final resort if these efforts do not result in eradication of the exotic plant.

These additional diver surveys, bottom barrier installation, and herbicide treatments are contingency elements to the overall aquatic plant control plan for the lake. Since these costs would only accrue in the event of another infestation by Eurasian watermilfoil or another exotic plant, the costs could possibly be covered through an "early infestation grant" by the Department of Ecology. However, due to grant uncertainties, a contingency fund has been included as one of the plan cost elements, to insure protection of the lake.

Plant Control Advisory Committee

Proper implementation of the described plan relies upon formation of a lake plant control advisory committee. This committee which would be comprised of area residents, County park staff, and other interested agencies, would have the following responsibilities:

- Review annual plant survey information and track potential problem areas.
- Insure permit requirements are met.
- Review submerged exotic plant problems and determine the appropriate control strategy and urgency of control needed.
- Recruit and direct volunteers for annual surveys.
- Select and hire contractors when necessary for tasks such as providing training, spraying, diving, and etc..
- Provide information and newsletters to lake residents and act as spokespeople for answering questions on plant control problems and supporting long term implementation of this plan.

PUBLIC EDUCATION PROGRAM

The public education program for Lake Wilderness consists of three parts; the exotic plant prevention plan previously described, lakeside stewardship education, and watershed protection/pollution prevention for protecting the lakes' water quality.

Exotic Plant Prevention

All watershed residents should be sent copies of an exotic plant prevention brochure. A group of lake homeowners should be trained to identify Eurasian watermilfoil and other invasive plants and perform periodic volunteer surveys of the lakeshore. The exotic plant prevention plan was described in detail in the Invasive Plant Prevention and Detection Program section.

Lakeside Stewardship Education

Each lakeside resident should be educated about how to reduce the amount of pollutants entering the lake from their property, as well as about things they should do to help retain a complex, diverse, and therefore healthier lake environment. The properties located directly adjacent to the lake have the greatest potential for adversely impacting the lake since pollutants generated on these properties have direct access to the water and no other defined surface inflows exist.

Lakeside property owners should be provided with information about problems associated with typical urban type landscapes around lake shorelines. This should include information on the drawbacks of using ornamental turf (lawns), and the benefits of adding shoreline plants and diversified lawn plantings which create habitat structure for birds and wildlife.

Some important considerations for proper stewardship of lakeside property are described here. Informative brochures or newsletter articles should be used to educate lakeside property owners about best management practices (BMPs). Some examples of stewardship ideas include:

- Limit turf and landscaped areas to no closer than 25 feet from the shoreline. Native plants and grasses should be considered for landscaped areas to decrease the amount of fertilizers, pesticides, and other pollutants used.
- Establish a "pollutant free zone" within 50 feet of the shoreline. Try to keep all pollutants; gas for boats, painting projects, landscape fertilizers and poisons, and etc. away from this zone.
- Plant a shoreline buffer of shrubs and tall grasses, preferably native species. This one small activity will cause multiple environmental benefits. If properly designed it will keep geese and other waterfowl from moving onto lawn areas. The vegetation will help filter out pollutants from landscaped areas before they reach the lake. It

will provide protection from shoreline erosion, and it will provide habitat for the many wildlife species that utilize nearshore areas.

- Preserve natural "structure" that exists along the shoreline and in the shallow nearshore area, or if necessary, clean up only a narrow strip alongside the dock area. If a tree along the shoreline finally falls in, leave it. Add structure in the form of tree tops, twig bundles, and rocks to diversify and naturalize the nearshore area and attract more fish and wildlife.
- Allow emergent vegetation, and other plants to colonize some portion of waterfront area.

Public education and involvement will also center around the annual plant survey. In the spring of each year the plant control advisory committee should plan a short workshop to describe plant survey results from the past year and the plant control strategy for that year (e.g. where and when Aquathol® will be applied). During the workshop, a schedule should be agreed upon for volunteer surveys. At this time everyone should be trained or re-trained on plant identification and survey techniques.

King County Water and Land Resource Division's Lake Stewardship Program is a resource for technical assistance and noxious week identification training within unincorporated King County and within contract cities. The program also offers speakers on lake-related topics and can tailor programs to the community needs. The Lake Wilderness community, in the newly formed City of Maple Valley, could continue to participate in the program for specific contracted services.

Watershed Protection/Pollution Prevention

Over the long term, the quality of Lake Wilderness may be most impacted by development activity in the watershed. Recommendation of watershed protection measures is beyond the scope of this plan, however lake residents should be aware of the potential impacts and take a pro-active role to insure protection of their lake. Lake residents need to monitor watershed related activities to insure that appropriate best management practices (BMP's) are being carried out in nearby commercial and residential developments. This should include; tracking where activities are occurring, reviewing permit applications to insure proper BMP's have been included, reporting violations to permit conditions or water quality standards, and generally keeping informed about the watershed problems.

Since much lake related public education information is already contained in available brochures, there is little cost associated with developing the information. A $1000 per year cost has been included for development and reproduction of brochures, with an additional $250 for mailing and postage. It is assumed that the first plant workshop would be done by a professional who can develop a training and survey program. After that the workshops would be put on by lake resident volunteers. The cost for the initial workshop was estimated at $1,500. This cost was included as part of the invasive plant protection program.

PLAN ELEMENTS, COSTS, AND FUNDING

Table 4 provides a summary of each element identified in this plan and the associated costs. Total cost for the plan for the first ten year period is estimated at $252,700, for an average of about $25,270 per year. The majority of the cost occurs during the first year when all the plan components are implemented simultaneously, some of these (e.g., volunteer training, and public education brochures) could be offset to the following year to spread out the costs. These costs are based on 1997 cost estimates. If an inflation rate of 3 to 5 percent each year is assumed, the 10 year cost will range from $293,000 to $314,000.

Implementation of the Lake Wilderness Integrated Aquatic Plant Management Plan is projected to occur over a 10-year period. A combination of grant funding and local revenue from lake management district (LMD) formation is proposed to fund the plan's implementation.

Grants

Implementation funding for the eradication of Eurasian watermilfoil could be obtained from the Washington State Department of Ecology (WDOE) Aquatic Weed Management Fund (AWMF) grant program. The AWMF grant program funds a variety of aquatic plant management projects statewide. Grants are awarded annually on a competitive basis. Local jurisdiction are eligible to compete for up to $75,000 annually.

Lake Management Districts

A lake management district (LMD) is a locally-defined special assessment used to raise revenue to implement lake protection or improvement activities. Property owners on or near a lake pay a special charge on their property, either annually or on a one-time basis. A LMD can be formed for up to a 10-year period. LMD's have been formed and operated successfully in King, Snohomish and Thurston counties.

Section 36.61 of the Revised Code of Washington (RCW) describes the process for LMD formation. According to the law, an LMD can be initiated through a petition to the City or County Council by property owners of at least 15 percent of the acreage within the proposed LMD boundary or by the Council who can adopt a resolution of intention. The petition or resolution of intention needs to include the following information: (1) proposed lake protection or improvement activities; (2) total amount of money to be raised; (3) whether money will be collected annually or one-time only; (4) amount of assessment (one-time or annual); (5) duration of LMD; and (6) proposed LMD boundaries.

After the petition is adopted or the resolution of intention is passed, a public notice is sent and a public hearing is held. This is followed by a special election in which each property owner has one vote for every dollar of proposed assessment. The proposed LMD must be approved by a simple majority of the votes cast. If there is a positive vote, the Council adopts an ordinance to create the LMD. If there are no appeals, the Assessor prepares a special assessment roll which lists each property and the proposed special assessment. There is a second public hearing at which individuals can raise objections to the amount of the special assessment. The Council may revise

the special assessment roll in response. Then the special assessment roll is confirmed and billing can proceed. The money is administered by the City or County but a community-based advisory board can be appointed by the Council to oversee the project expenditures.

Sample Funding Scenarios

Total 10-year implementation costs are projected to total $252,700 (Table 4). To illustrate how costs might be spread out over a ten-year implementation period, three funding scenarios are presented (Table 5). In Scenario A, funding of the management plan is assumed to come from a LMD that is comprised of lakefront property owners only. Currently, there are 71 lake front parcels with 58 individual owners. Assuming that the LMD was structured based on ownership rather than strictly parcels, each owner would need to contribute $438 annually for the 10-year period (Table 5).

In Scenario B, the LMD would be structured around three zones: waterfront residents (zone 1), subdivision households (estimated 332 total) with lake access (zone 2), and the park property (zone 3). In this scenario, waterfront residents would support 40 percent of the implementation costs, subdivision residents would support 30 percent of the costs, and the park property would support the remaining 30 percent of the project's 10-year costs. Each zone's annual costs are summarized in Table 5.

In Scenario C, 75 percent of the first-year Eurasian watermilfoil eradication costs (which total $87,250) are assumed to be grant funded. The remaining costs are assumed to be supported by three-zone LMD structured as described in Scenario B. Annual costs for Scenario B are shown in Table 5.

Table 5: Examples of Possible Funding Scenarios

Scenario	Assumptions	Annual Costs		
		Zone 1	Zone 2	Zone 3
A	Fully Funded by 1 Zone LMD	$438		
B[(1)]	Fully Funded by 3 Zone LMD	$178	$23	$7611
C[(1)]	First Funded by Grant, Remainder Funded by 3 Zone LMD	$132	$17	$5648

[(1)] *A three-zone LMD comprised of waterfront residents (zone 1), subdivision households with lake access (zone 2), and the park property (zone 3) is proposed with each zone supporting 40, 30, and 30 percent of the total 10-year implementation costs, respectively.*

The funding scenarios shown in Table 5 are intended to serve as examples of how costs might be apportioned among watershed residents who would benefit from implementation of the management plan. The costs presented in Table 5 are intended to show a range of possible implementation costs. The Lake Wilderness Steering Committee has agreed to further explore funding of the management plan and other alternative funding scenario after the plan is finalized in April 1997.

If exotic plants are reintroduced to the lake after Eurasian watermilfoil eradication has occurred, early-infestation grant funds may be available through WDOE for their control. However, due to grant uncertainties, a contingency fund should still be set aside to cover this possibility.

IMPLEMENTATION AND EVALUATION

The following is a detailed step-by-step approach to implementation of this plan:

Step 1) Set up a Plan Implementation Committee

The first step to implementing the plan is to set up an organization or committee that will take responsibility for it. The lake community will control how and whether the plan is implemented. Many of the tasks this committee will need to carry out are described in the plan under the "plant control advisory committee" section.

Step 2) Secure a Funding Source

Plan implementation for the first year will cost an estimated $81,250, and long-term funding for a full 10 year period has been estimated to cost $252,700, or an average of $25,270 per year. The source for this money should be identified and a budget created.

Step 3) Apply for a Plan Implementation Grant

Grants for up to $75,000 are available through the WDOE Aquatic Weeds Program for implementation of approved Aquatic Plant Management Plans. Lake residents should work through the City of Maple Valley (with possible assistance from King County) to apply for these grant funds. Applications are due in the fall. To insure adequate time for preparation of applications, this step should begin by mid summer.

Step 4) Apply Sonar®

A bid to apply Sonar® should be prepared for release by April of 1998, allowing two weeks for bidders to respond. The bid should include preparation of permit applications, application costs, and follow-up monitoring to characterize the success of the application. Application should be scheduled to occur by late June.

Step 5) Prepare a Public Education Plan

Meet with King County lake stewardship program staff and collect available brochures. Encourage or elect a lake volunteer to participate in the King County Lake Stewardship Program. Solicit professionals to volunteer to make presentations to the community and set up dates for presentations. Also develop an article for each newsletter describing different lake protection issues.

Step 6) Institute a Long-Term Plant Monitoring Program

Develop a list of lake volunteers interested in conducting annual aquatic plant surveys. Develop a plan for training volunteers, doing the surveys, and handling and reviewing information. Contact professional aquatic plant experts for conducting bi-annual surveys.

Step 7) Apply Aquathol®

A bid to apply Aquathol® should be prepared for release by April of 1999, allowing two weeks for bidders to respond. The bid should include preparation of permit applications, application costs, and follow-up monitoring to characterize the success of the application. Application should be scheduled to occur by mid- to late June.

Step 8) Conduct Annual Evaluation

Complete a written annual evaluation that describe what elements of the plan have been implemented, relates the existing plant community to established goals, and makes recommendations for the next years activities.

As implied in Step 8, it is important that there is some mechanism in place for periodic evaluation of this plan and determination of whether it is meeting stated goals or whether the goals have changed. This evaluation should be done on a yearly basis. It should begin with a description of which elements of the plan have been fully implemented, which have not, and why. It should also include a summary of the plant monitoring results, both those obtained by volunteers and those by professionals. These results should be used to aid in the determination of whether goals have been met. The community should also be asked for input on their satisfaction with plant conditions. For example, it is possible that the goals will be met, but that some people will remain dissatisfied. Although it is unlikely that everyone's needs will be met, an effort should be made to track concerns, especially if they are widespread. This information should be used to decide on the following years activities; Does a herbicide treatment need to be scheduled? Has there been a re-infestation of Eurasian watermilfoil? Have any other invasive plant been identified? Do handtools need to be purchased? Is it necessary to implement the back-up or contingency plan? Over the long-term, adequate annual evaluations can make the difference between project success or failure.

SUMMARY AND CONCLUSIONS

Eurasian watermilfoil infestation in Lake Wilderness has increased since its discovery in 1994. Without some sort of action plan the aerial coverage of the plant is likely to increase and further impede recreational use of the lake. This report details a plan for eradicating Eurasian watermilfoil with the use of a whole-lake herbicide treatment (Sonar®) and selective herbicide use (Aquathol®) for the long-term control of submersed plants. Implementation of this plan is estimated to cost a maximum of $252,700 over ten years, or a maximum average of $25,270 per year.

Re-invasion by Eurasian watermilfoil or other non-native plants will be closely monitored through annual diver surveys and a contingency plan is included in case invasions do occur. Public education and awareness programs will be focused on exotic plant

prevention, and providing general pollution prevention and best management practices information to lake residents.

Lake residents will be involved in development of the yearly plant control strategy and will be responsible for soliciting volunteers for surveys and plant control activities. This will insure long-term involvement of lake residents in lake management decisions and activities.

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APPENDIX A

AQUATIC PLANT CONTROL METHODS AND STRATEGIES CONSIDERED FOR LAKE WILDERNESS

AQUATIC PLANT CONTROL METHODS REVIEW

The following is a description of the methodologies initially considered for control of native and non-native submerged plant populations in Lake Wilderness. Essentially two methods are available to achieve control of the Eurasian watermilfoil; use of the herbicide Sonar® and stocking with Grass Carp, and there are at least two additional methods for long-term control of the native plants. There are additional elements described in the Contingency Section that might be associated with each control strategies such as use of hand tools and bottom barriers. Following a description of each methodology is a summary of the five control strategies presented to the Steering Committee. Each of the five strategies includes a combination of methodologies available to achieve the aquatic plant management goals of Lake Wilderness.

Eurasian Watermilfoil Eradication

Herbicides - Whole Lake Sonar® Treatment

Of the herbicides currently approved for use in Washington State, fluridone is the preferred herbicide for submerged plant control. Fluridone is a slow-acting, systemic herbicide that is applied to the water surface either as a liquid or slow-release pellets. The slow-release pellets were developed to provide greater exposure to plants where there are currents keeping the water moving. The more intense labor involved in spreading the pellet form makes its use more expensive than the liquid. Fluridone is formulated as Sonar® for aquatic application.

At Lake Wilderness, Eurasian watermilfoil is concentrated throughout the lake. Once Eurasian watermilfoil has infested a lake it will continue to proliferate until it becomes the dominant submerged plant. Fluridone has been found to be extremely effective at eradicating Eurasian watermilfoil in Washington State lakes through whole lake treatments.

Fluridone is effectively adsorbed by plants and translocated by both roots and shoots and then inhibits carotenoid synthesis. Carotenoids (yellow pigments) are an important part of the plant's photosynthetic (food making) system. The carotenoids protect the chlorophyll (green pigments) from decomposition by sunlight (photodegradation). When carotenoid synthesis is inhibited, the plant is exposed to photodegradation and is gradually destroyed. Effects of fluridone treatment become noticeable within 7 to 10 days of application, with complete control often requiring 60 to 90 days. Within one to two weeks after the first treatment, Eurasian watermilfoil will start to show signs of chlorosis, the tips of the plants and leaves will start to bleach out. It takes approximately 10 weeks for the plant to fall out of the water column.

The use of fluridone is most applicable to lake-wide treatments. In order for the herbicide to be effective it must remain in contact with the plants for extended periods of time. When used for spot treatments fluridone has a tendency to become dilute resulting in an ineffective treatment. In whole lake applications fluridone concentrations

can be applied and maintained for several weeks resulting in sufficient plant/herbicide contact time to kill targeted plants. Therefore, the control zone typically includes the entire open water area of the lake.

Because it kills the plant and roots it has a relatively long control duration; four to five years. Fluridone is selective towards dicotyledonous plants and is effective at eliminating the non-native Eurasian watermilfoil. Many of the local native pondweeds are monocotyledonous species which may survive exposure to fluridone. Fluridone does not affect the beneficial macroalgae *Nitella* that presently grows in Lake Wilderness.

Advantages of fluridone are that the treatments are low cost coupled with relatively long-term control of the plants. It is considered to have very low toxicity to aquatic animals and comes with no swimming or fishing use restrictions. The only water use restriction for Sonar® applications is a "precaution" against using the water for irrigation. It is recommended that treated water should not be used for irrigation of turf or plants for a period of 14 days. It is a chemical control method and therefore there are implied concerns associated with the use of toxins in natural environments. Other than chemical use concerns, the primary drawback of fluridone use is the water quality impact from the release of nutrients by decaying vegetation. An additional drawback of fluridone is that it requires a whole-lake treatment to be effective and therefore cannot be used to target specific zones and impacts beneficial submerged plants as well as nuisance plants. Treatment costs by private contractor range from $700 to $1,000 per acre. (It should be noted that the cost per acre used here is taken from an Ecology reference manual for developing aquatic plant management plans. The actual cost of the most recent fluridone (as Sonar®) treatment of Steel Lake was $15,000 for two applications (one treatment). The higher cost estimate was used to provide the most conservative estimate of the expected cost for implementation of this alternative.)

To control Eurasian watermilfoil in a lake system, 10 parts per billion of fluridone must be maintained in the vicinity of the weed for eight to ten weeks. An initial treatment would be made in the early summer at 20 parts per billion. This application rate accounts for the entire volume of the lake where fluridone will mix. Fluridone will begin photodegrading soon after application. Subsequent treatments would be scheduled at two, four, six, and if necessary, eight week intervals. Prior to follow-up treatments, water samples are collected in the vicinity of the target vegetation and analyzed for fluridone concentrations. This data is then used to determine the quantity of herbicide needed to maintain 10 to 20 parts per billion. This methodology has been used to eradicate Eurasian watermilfoil from a number of Washington lakes including Steel and Killarney Lakes in Federal Way. Both of these systems were very similar to Lake Wilderness prior to treatment.

Permits are required from Ecology prior to any aquatic herbicide treatment. Once a permit has been granted, a number of public notification requirements must be fulfilled prior to the application.

Grass Carp

Grass Carp are plant-consuming fish native to China and Siberia. Sterile (triploid) Grass Carp are raised in the southeast US for lake-wide, low-intensity control of

submerged aquatic plants. Known for their high growth rates and wide range of food preference, these fish can control certain nuisance aquatic plants under the right circumstances. Stocking rates depend on climate, water temperature, type and extent of plant species, and other site-specific conditions. In 1990, Washington state adopted Grass Carp regulations that require the following conditions:

- Only sterile (triploid) fish can be planted.
- Inlets and outlets must be screened to prevent fish from getting into other water bodies.
- To insure sufficient vegetation is retained for fish and wildlife habitat, stocking rates are defined by WDFW based on the current planting model.
- Lakes with public access require a lake restoration study.

Effectiveness of Grass Carp in controlling aquatic plants depends on feeding preferences and metabolism. Recent laboratory and field studies in Washington state indicate that thin-leaved Pondweeds and *Elodea canadensis* are highly preferred, broad leaf Pondweed and Eurasian watermilfoil are less preferred, and that Waterlilies are generally not eaten. The primary advantage of Grass Carp is the low cost (if a lake restoration study has been performed).

Primary drawbacks are that effects are unpredictable and that all beneficial plants may be removed, resulting in serious impacts to fish and wildlife. It takes a number of years for the Grass Carp population to reach the size where they can effectively reduce the plant population, thus they do not achieve immediate control as chemicals do. Lake residents would need to be willing to accept existing plant populations for a 3-5 year period to allow the carp to grow. The main disadvantage from a management viewpoint, is that the carp represent an unknown level of control. Results from stocking projects have been mixed. If the stocking rate is too low, the carp are not able to effectively control the plants. Conversely, if stocked too high they can completely eradicate aquatic plant populations. If the latter occurs, there can be serious long-term affects on fish, waterfowl, and other wildlife. In addition, it can be difficult to obtain a stocking permit from Washington Department of Fish and Wildlife (WDFW) due to the potential impacts to fish and wildlife.

Costs range from $50 to $2,000 per acre, at stocking rates ranging from 5 to 200 fish per acre and average cost of $15 per fish. However, additional costs would likely include more than $200,000 for an environmental checklist, Phase I lake restoration study, and outlet screening required by the fish planting permit. In addition to a game fish planting permit, hydraulic project approval permit (HPA) is required by WDFW for installation of screens.

Long-Term Control of Native Plants

Dredging

Dredging, or removing accumulated sediments has typically been used to either deepen a lake, or to remove nutrient laden sediments for water quality improvement. It

can also be used to control the amount and type of aquatic plant habitat present. This is based on the idea that different plant types grow best at different water depths, therefore, if sediments are removed (causing deeper water) plant types will change accordingly. If enough material is dredged to reach background soils that do not support aquatic plant growth, then dredging actually results in elimination of plant habitat.

Cutter-Head Dredge

A portable cutter-head dredge could be used to remove sediment and plant material from the lake. A slurry of chopped plant material, sediment and lake water is pumped to shore for dewatering and disposal. This would result in short-term, localized water quality impacts, but can also result in long term improvement in lake water quality due to removal of nutrient laden sediments.

The design of the dredging program could vary widely from increasing the depth of the entire lake by 4 feet or more, to dredging a narrow band within the Eurasian watermilfoil zone to decrease available habitat. Costs would change accordingly, since cost is based on the volume of material removed. Costs for dredging can be expected to vary widely depending upon project objectives and disposal options. A minimum cost would be close to $500,000, while a large-scale project could be three to four times that estimate.

Advantages of dredging are the high intensity and long duration of control, and the benefit of increased water depth. For a small dredge project (small area and minimum depth gain) the duration of control may exceed 10 years for isolated local control for some plant species but is dependent upon the availability of propagules for recolonization. A small-scale dredging operation in shallow areas of the lake is unlikely to significantly improve water quality by removing nutrient-rich sediment, nor is it likely to significantly reduce suitable habitat for growth of submergent vegetation. A full-scale dredge project could result in large-scale reductions in available plant habitat, improved water quality, and a control duration of 10-50 years. The primary drawback of dredging is the high cost.

Diver Dredge

Alternatively, submerged plants could be controlled with diver-operated suction dredging of shallow sediments and roots. Suction dredging typically filters plant material and returns removed sediment and water to the lake. Material returned to the lake would temporarily decrease water clarity, but should not have long-term effects on water clarity. Costs of suction dredging are lower than cutter-head dredging because disposal costs are reduced. The primary advantages of diver-dredging is that it can be site and species specific, there are no obstacle or depth constraints, and there are no associated disposal costs since all material is returned directly to the lake. Disadvantages are that it is slow and labor intensive and therefore expensive. Also, the process can result in production of plant fragments that can re-root and cause problems in other places.

Unit costs of suction dredging range from $1,100 to more than $2,000 per day. Assuming a daily rate of 0.5 acres at $2,000 per day, the 10-year cost of controlling 10

acres is $40,000. However, costs would double if regrowth requires additional control in the 10-year period.

Dredging requires hydraulic approval from the Washington Department of Fish and Wildlife, and a temporary modification of water quality standards from the Washington Department of Ecology.

Mechanical Harvesting

Mechanical harvesting involves cutting plants below the water surface, conveying them onto the harvester, and offloading them at the boat launch for disposal or composting at a suitable site. Harvesters are manufactured by several companies; various sizes and features are available to meet specific requirements. Maximum cutting depths range from 5 to 8.2 feet with a cutting width or swath of 6.5 to 12.1 feet.

Harvesting provides immediate control of the problem plants, but the duration of control depends on water depth, the depth of cut, and harvesting coverage. However, harvesting can only be expected to achieve temporary reduction in plant biomass and does not change the areal coverage of the infestation. Significant long-term (year-to-year) harvesting impacts should not be expected (Perkins and Sytsma 1987). Past experience with harvesting a dense Eurasian watermilfoil infestation in Seattle's Green Lake indicates that adequate control for recreational use of a lake required several cuts per season depending upon the growth pattern in a particular year (KCM 1995).

Unit costs for harvesting are roughly $1,500 per acre per year for floating-leaved plants and $375 per acre per year for submerged plant control. The primary advantages of harvesting are the immediacy of the control and the fact that plant material that would normally add to the lakes nutrient load and cause increased sedimentation is removed from the lake. The primary drawback of harvesting is the shorter duration of control and therefore the need for repeated cuts. Mechanical harvesting requires hydraulic approval from Washington Department of Fish and Wildlife.

Aquathol®

Aquathol® is a contact herbicide; it affects many types of plants but does not impact the root system. This means it does not kill plants entirely but "knocks them back" for the year. Because of this it requires annual applications. Aquathol® has a number of use restrictions for treated waters. The Federal label on this product places no restriction on the use of treated waters for swimming, but has a 3 day fish consumption restriction of fish caught in the treatment area, and a 7 to 21 day restriction on irrigation or water supply use that is dependent upon application rate. In Washington State, there are additional restrictions: applicators must post a swimming restriction of 8 days, a 3 day fish consumption restriction, and a 35 day irrigation or portable water use restriction.

One of the benefits to using Aquathol® is that it can be used to spot treat specific areas, thereby keeping the costs lower relative to whole-lake herbicide treatments. As with most chemicals, one of the advantages of their use is that aquatic plants will begin to die back within 7 to 14 days. The main disadvantage of using Aquathol®, other than general concerns always associated with the use of chemicals in aquatic environments, is that it can be expensive and requires an annual effort to maintain aquatic plant

control. Unit costs for an Aquathol® treatment is roughly $610 per acre per year for submerged plant control.

Contingency Methods

The methods for aquatic plant control in this section are intended to be used in conjunction with other methods described above. These contingency methods may be used to enhance the effectiveness of the Eurasian watermilfoil eradication strategy or as part of the long-term native plant control. Most of the methods listed below are intended for small area control and may be suitable for lakeshore residents to use along their personal property.

Hand Pulling

Hand pulling is a manual method of removing the entire plant, including roots. It is typically performed by divers uprooting individual plants, placing them in a mesh bag, and disposing or composting the removed material. Handpulling is not limited by depth or access problems, and in theory all problem areas could be controlled in this manner. However, the labor intensive nature of the work would limit control attained by this method. Adequate control would be achieved by hand pulling plants once during early summer of each year in designated areas. Continual use of this method should help limit expansion of plant beds and maintain lower overall densities of the problem plants. The plant density and the level of effort should decrease in subsequent years.

Costs for hand pulling by contract divers range from $500 to $2,400 per day. Low to moderate pondweed densities could be controlled at a rate of approximately 0.5 acres per day. The primary advantage of hand pulling is that non-target (beneficial) plants are not removed and may even colonize area inhabited by nuisance plants, due to the large competitive advantage they would be given. The primary drawback is the high cost per unit area controlled due to the high labor cost. A Hydraulic Project Approval permit (HPA) from WDFW is required for large scale handpulling efforts.

Hand Cutting

Hand cutting tools are available for controlling submerged plants. For example, the Water-Weeder® is a battery-powered, hand-held cutter that cuts a 4-foot swath down to 12-feet deep, and can be purchased for approximately $500.

Hand cutting tools should allow adequate control within some problem areas identified in Lake Wilderness. The control zone would primarily be limited by the amount of labor available. Acreage located near private property could be controlled by individual property owners. Approximately two cuts per year should be adequate to maintain native plants to an acceptable level.

Plant fragments should be removed to prevent aesthetic impacts from floating debris and onshore decay of the plant material as well as the re-rooting of plant fragments. Cut fragments float and are best removed with a modified fish seine that encircles small working areas or is positioned down-wind of the working area. The modified fish seine

costs $500. The net should have at least a 1-inch mesh so that it will not trap small fish.

There are no depth limitations for these tools and therefore the control zone for this method could include any portion of the lake. However, since it requires manual labor it is best suited for small patches of plants that may be hindering lake access. Because plant roots and/or tubers are not removed using these tools, the duration of control is comparatively low. The frequency of application is dependent on water depth; monthly cuts will maintain deep areas, but more frequent cuts may be necessary for areas less than 3 feet deep.

The primary advantage of hand cutting is the low cost and the ability to be selective about the area controlled. The primary drawback is the high amount of labor required to provide adequate control. It has been estimated to require about one hour to cut a 50'x100' area when using a boat to assist the effort.

Weed Rolling

The Weed Roller is a relatively new product that controls aquatic plant growth by periodically disturbing the lake bottom. The drive head is typically mounted to the end of a dock in water depths of up to 8 feet. It slowly rotates a string of three aluminum tubes which repeatedly roll over a broad arc on the lake bottom. Each 6-inch by 10-foot tube is connected with a flexible coupler to follow the bottom contour. The Weed Roller converts 110-volt household current to 24-volt direct current (DC) and covers up to a 270° sweep in 15 minutes. Adequate control is typically achieved by operating the Weed Roller continuously overnight once every week or two during the growing season.

Since a power source and structural support is required to operate the weed roller, the control zone is limited to area directly adjacent to docks. King County Surface Water Management Division tested the use of these Weedrollers at three lake sites during 1995. The Weedroller was found to effectively decrease waterlily and Eurasian watermilfoil stands from 50-90% coverage to less than 25% coverage with fewer than 12 hours of operation a month. Some temporary indirect affects were noted for increased water turbidity and possibly affects on bottom dwelling organisms.

A complete unit with accessories sells for approximately $2,500. This cost does not include installation and electricity. This tool would not be considered for use on the large lily bed due to lack of a power source, installation , and ineffectiveness for controlling large areas. Advantages of the Weed Roller include the high degree of control, low amount of labor, and the fact that it will control all plant types within its path. The main drawback is the limited area of control. Also, the plant fragments that are formed can cause problems for nearby residents if not removed. The Weed Roller requires hydraulic approval from the Washington Department of Fish and Wildlife.

Bottom Barriers

Bottom barriers are manufactured sheets of material that are anchored to the lake bottom to prevent plants from growing, similar to weed barriers commonly used in lawn and garden activities. Several bottom covering materials have been used with varying degrees of success. A woven polyester material such as Texel® (is one of the most

effective bottom barriers because it is durable and it provides efficient exchange of gas produced from decaying organic matter (roots). It is typically installed in the winter by unrolling sections and anchoring them with sand bags spaced 10 feet apart. Generally, the material is in a 15 foot wide roll that is rolled out to the selected length. Bottom barriers should be maintained on an annual basis to ensure adequate coverage and anchoring. Bottom barriers can be relocated to other areas after 2 years if sediment accumulation is not excessive. Re-installation may be necessary to control encroachment of plants in areas adjacent to dense growth.

There are no limits to the control zone for bottom barriers. They are effective in deep as well as shallow water and do not have special requirements that eliminate their use in different areas. The control zone would be defined by the square footage of material installed. Control intensity and duration varies depending upon sediment accumulation and encroachment from adjacent area. If properly installed and maintained annually, bottom barriers can provide a high level of control for five years or more.

The cost of applying bottom barriers is approximately $0.80 per square foot ($35,000 per acre). Annual maintenance costs are estimated to be $3,750 per acre. The primary advantage of bottom barriers is the intense level of control and the ability to be very selective about the control area. The main disadvantage is the high cost per acre controlled. Bottom barriers require hydraulic approval from the Washington Department of Fish and Wildlife and a shoreline permit from King County.

PLANT CONTROL STRATEGIES FOR LAKE WILDERNESS

There are two areas of concern associated with the aquatic plant community in Lake Wilderness; Eurasian watermilfoil eradication, and the long-term control of native submerged plants. After presenting the wide range of available alternatives for control of each plant community type, five different control strategies were presented to the Lake Wilderness steering committee for consideration in selecting a recommended action plan. Each of these scenarios involved a combination of techniques such as:

Strategy 1A. Sonar® and Harvesting

A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, and harvesting for the long-term control of submerged native plants

Strategy 1B. Sonar® and Aquathol®

A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, and the use of Aquathol® for the long-term control of submerged native plants

Strategy 1C. Sonar® and Dredge

A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, and dredging of the lake for the long-term control of submerged native plants

Strategy 2. Grass Carp

Stocking of the lake with Grass Carp for long-term control of both Eurasian watermilfoil and submerged native plants

Strategy 3. Sonar® and Grass Carp

A whole-lake Sonar® treatment for the eradication of Eurasian watermilfoil, followed by the stocking of the lake with Grass Carp for the long-term control of native plants.

Strategy 1A through 1C

These strategies are described together because they contain the same initial treatment method for eliminating the Eurasian watermilfoil, which is use of a whole-lake Sonar® treatment. Strategies 1A, 1B, and 1C differ in how long-term control of native plants is achieved. Under these strategies Sonar® would be applied in a liquid form. As discussed above, the application protocol requires that the entire lake is treated with enough of the chemical to reach an in-lake concentration of 20 parts per billion (ppb) and that a concentration of 10 to 20 ppb is held within the lake for at least a six week period. This requires close monitoring of the lake, and additional herbicide applications every two week. Sonar® when applied in this fashion has been proven to be highly effective in eliminating Eurasian watermilfoil.

Cost for the treatment, including the initial and follow up applications, has been estimated at $80,000. Because the purpose of the Sonar® treatment is to eliminate

Eurasian watermilfoil from the system, follow up diver surveys should be scheduled for the following three years to insure any remaining plants are quickly removed before they can again colonize the entire lake. The Sonar® application should also include setting aside contingency money to remove any new infestations found during the surveys. A contingency fund of $4,000 to $8,000 per year should be set aside. Contingency actions (and associated costs) will be dependent upon the extent and the location of future infestations. A few plants spread out over a small area can be hand pulled by divers. Larger infestations that are found in one or two areas may be best controlled by bottom barrier, while those spread throughout the lake may be controlled with spot treatments of Sonar® in pellet form (Sonar® SRP) or another chemical if others become approved for use in Washington State (e.g., Trichlopyr). The total cost for the Sonar® treatment including follow-up dives and contingency funds is estimated at $92,000 to $104,000 over 10 years or $9,200 to $10,400 per year, if averaged over a 10 year period.

Strategy 1A - Sonar® and Harvesting

The long-term control of native plants included in this strategy would rely on mechanical harvesting. Harvesting would occur twice each summer. Assuming a cost of $375 per acre and 28 acres of submerged plants are controlled, this would cost an estimated $21,000 each year. (It is possible that one cut per year would be sufficient to maintain the native plants which would reduce the cost by half. Cost could also be reduced by identifying areas that did not need to be controlled and reducing the total number of acres harvested.) One of the advantages of harvesting is that there is no long-term use of chemicals in the lake, which is often a concern of lake residents. Additionally, since decaying plants add nutrients that feed algal blooms as well as increase the rate of sedimentation (filling in) in the lake, their direct removal can provide an advantage for long-term health of the lake. The disadvantages of this strategy is that it is expensive, requires an annual effort, and it should not be done if Eurasian watermilfoil returns to the lake. Harvesting of Eurasian watermilfoil has been shown to exacerbate the problems associated with this invasive plant. If the costs for the Sonar® treatment is included, implementation of this strategy would cost a total of $302,000 to $314,000, or approximately $30,200 to $31,400 per year if average over a 10 year period.

Strategy 1B - Sonar® and Aquathol®

Strategy 1B relies on the chemical Aquathol® for long-term control of the native submerged plant community. Aquathol® treatments would be required annually since this herbicide does not impact the root system of the plant. If Aquathol® were applied to the entire 28 acres of submerged plants it would cost $17,000 each year. However, costs would be reduced if less acreage were treated. The advantage to using Aquathol® is that the plants will begin to die back within 7 to 14 days. The disadvantages of this treatment strategy are that there are water use restrictions such as an 8 day swimming restriction, a three day fish consumption restriction, and a 35 day irrigation or portable water use restriction. Including the cost for a Sonar® treatment, implementation of this strategy would cost a total of $298,000 to $310,000, or approximately $29,800 to $31,000 per year if averaged over a 10 year period.

Strategy 1C - Sonar® and Dredging

This strategy is included primarily for comparison purposes and to demonstrate what would be required to achieve a more permanent change to the plant community rather than relying on annual short-term efforts. This strategy involves removing built up sediments from around the lake shoreline through a sediment dredging project. Deepening the shoreline and removing sediments would result in a number of benefits. The simplest is that plants, roots, and tubers would be removed entirely from the lake within the dredged area. More important, since where plants grow is largely dependent upon light being able to penetrate the water column to a particular depth, deepening the shoreline would greatly decrease the area where plants could grow. The more material removed, or the greater depth achieved, the greater the reduction in plant habitat. Dredging also removes nutrient laden sediments from the lake which can cause an improvement in lake water quality. Dredging is an extremely costly alternative when compared to more temporary control strategies. It has been grossly estimated that removal of 5 feet of sediment over 28 acres would cost from $1.6 - 3.6 million dollars, or $160,000 to $360,000 per year over 10 years. Costs for the initial Sonar® treatment have not been included since the additional expense would be overshadowed by the large range in cost estimated for dredging.

Strategy 2 - Grass Carp

The final two strategies involve the use of Grass Carp to control aquatic plants. Strategy 2 would rely entirely on the use of Grass Carp. It is the only strategy considered that does not utilize Sonar® or any other chemical treatment method for aquatic plant control. Use of Grass Carp is the lowest cost alternative considered. It is estimated to cost $84,00 for initial purchase of the fish. (This assumes a maximum stocking rate of 20 fish per vegetated area and a cost of $15 per fish). A permit to stock Grass Carp must be obtained through the Washington State Department of Fish and Wildlife (WDFW). There are a number of requirements that must be met before obtaining a permit such as screening the lake outlet. Screening the lake outlet would result in an additional cost of approximately $10,000. Annual monitoring especially of aquatic plant populations might also be required. An additional $2,500 per year for 10 years has been estimated to meet monitoring needs. Currently, the stated WDFW policy requires that a Phase I study of the lake be completed prior to stocking the lake. A Phase I study would cost a minimum of $100,000. If a Phase I study is required, the total cost over a 10 year period for implementing this strategy is estimated at $144,400 or approximately $14,440 per year. If the Phase I study requirement is retracted, the total cost is estimated at $44,400, or $4,440 per year if averaged over a 10 year period.

In addition to the low cost, stocking with Grass Carp has the advantage of eliminating the need for future annual efforts to control plants. Every five years or so additional Grass Carp would need to be added to the lake to replace those lost to mortality, however this would be a minimal expense item (e.g., $500 for each replenishing effort).

As stated in the methods section, there are disadvantages to using Grass Carp to control aquatic plants. It takes a number of years for the fish population to reach the size where they can effectively reduce the plant population, thus they do not achieve immediate control as chemicals do. Lake residents would need to be willing to accept existing plant populations for 3 - 5 years to allow the carp to grow. The largest disadvantage for a management point of view, is that it can be difficult to stock to the appropriate level of aquatic plant control (e.g., over stocking versus under stocking). In addition, it can be difficult to obtain a stocking permit from WDFW since the agency is concerned about potential impacts to fish and wildlife and is reluctant to approve permits in natural, high use, public water bodies.

Strategy 3 - Sonar® and Grass Carp

The final strategy (3) is to use Sonar® first to eliminate the Eurasian watermilfoil. This would allow removal of the most significant problem plant before the carp are stocked. Further, since the Sonar® also affects native plant populations for the first year or so, the entire submerged plant population would first be reduced. This would allow a reduction in the number of Grass Carp stocked and possibly allow a better prediction of the number needed. The cost for the initial Sonar® treatment would be $80,000 as previously described. The same cost estimate for stocking Grass Carp as under Strategy 2 ($8,400) was used to be consistent in providing a conservative estimate of cost comparisons. However, it is likely that the stocking rate would be reduced under this strategy. The total cost over 10 years would range from $124,400 to $224,400 depending upon whether a Phase I study was required. The estimated average annual cost would therefore be between $12,440 to $24,440 per year.

APPENDIX B

AQUATHOL AND SONAR FACT SHEETS

Washington State Department of Health

Environmental Health

Office of Toxic Substances Fact Sheet

May 1994

FLURIDONE (SONAR®)

WHAT IS FLURIDONE?

Fluridone (1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone) is a fluorinated pyridinone-based aquatic herbicide (Trade name: Sonar®). Fluridone is a systemic herbicide that is absorbed from water by plant shoots and from hydrosoil by roots. Fluridone controls aquatic plants by inhibition of carotenoid synthesis.

Fluridone has a water solubility of 12 ppm. It was initially registered with the U.S. Environmental Protection Agency in 1986 and is sold in granular or liquid form.

PUBLIC HEALTH

Drinking water. Fluridone cannot be used within 1/4 mile of a drinking water intake. Potential routes of exposure to the general public are: 1) drinking treated water, 2) swimming in treated water, and 3) eating aquatic organisms from treated water. Washington State Departments of Ecology (Ecology) and Health (DOH) reviewed these three routes of exposure and concluded that no adverse health effects are anticipated from exposure to fluridone if used according to label instructions.

Ground Water. No direct ground water contamination issue is associated with the application of fluridone to aquatic sites. There are no label restrictions for drinking (with the exception of 1/4 mile buffer for a potable water intake), swimming, or fishing in water treated with fluridone. Fluridone is degraded primarily by photolysis, biodegradation, and volatilization.

RESTRICTIONS

Recreation. There are no swimming restrictions associated with fluridone treatment.

Agricultural Crops. There is no evidence that ingestion of treated agricultural crops would be of human health concern. Plants irrigated with fluridone-treated water would likely be injured or killed.

Fish. Fluridone has no fishing restrictions and fish are not significantly affected at treatment concentrations. According to Ecology documents reviewed by DOH, ingestion of aquatic organisms does not pose a threat to human health (as calculated from a daily fish ingestion rate multiplied by a bioconcentration factor). The bioconcentration factor of fluridone in fish ranges from 0.9 to 15.5 (a value of 100 is usually regarded as significant). Thus, there is a very low probability that fluridone will bioaccumulate or biomagnify in fish.

TOXIC SPILLS

There have been no reports of significant exposure to fluridone through spills. In case of a large spill, material should be prevented from flowing into streams, ponds, or lakes.

OTHER POTENTIAL CONCERNS

Other Potential Concerns. Fluridone itself has not been shown to be teratogenic, mutagenic, or carcinogenic. However, NMF (N-methyl formamide), a photolytic breakdown product of fluridone under artificial conditions but an unlikely breakdown product under natural conditions, is a potential teratogen, fetotoxin, liver toxin, and cell toxin in animals exposed to elevated levels. NMF has never been observed under natural conditions where fluridone was applied at label amounts. Using data from animal studies and worst-case exposure estimates, Ecology and DOH agree it is unlikely for fluridone and/or NMF to cause harmful effects to humans.

Little research has been conducted on synergistic effects of fluridone with other aquatic herbicides.

Inert ingredients included in the formulation of fluridone are confidential and under control of the parent company. Consequently, DOH requested and received a list of inert ingredients which were then reviewed for toxicity. DOH concluded that these chemicals are not of human health concern at applied concentrations.

FOR MORE INFORMATION

Please contact:

- Your Local County Health Agency
- Washington State Department of Health
  Office of Toxic Substances - (206) 586-5403
- Washington State Department of Ecology
  Water Quality Program - (206) 407-6400
- Washington State Department of Agriculture
  General Information - (206) 902-2010

Copies of this fact sheet may be obtained from your Local County Health Agency, or:

- Washington State Department of Health
  Office of Toxic Substances
  P.O. Box 47825
  Olympia, Washington 98504-7825
  (206) 586-5403

Material Safety Data Sheet

SePRO

Emergency Phone: 317-580-8282
General Phone: 1-317-580-8282

EPA Reg. Number: 67690-4
Effective Date: August 25, 1994

SONAR* A.S. Herbicide

SePRO Corporation • Carmel, IN

1. INGREDIENTS: (% w/w, unless otherwise noted)

1-Methyl-3-phenyl-5-(3-(trifluoro-methyl)phenyl)-4 (1H)-pyridinone (Fluridone)
CAS# 059756-60-4.....41.7%

Other Ingredients, total, including: 58.3%
Proprietary surfactants
Propylene glycol . . . CAS# 000057-55-6
Water . . . CAS# 007732-18-5

This document is prepared pursuant to the OSHA Hazard ommunication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: (@ 1 atmosphere) 212°F, 100°C

VAP. PRESS: 2.3 mm Hg at 25°C

VAP. DENSITY: 1.178 relative to air at 25°C

SOL. IN WATER: Disperses in water

SP. GRAVITY: 1.15 at 25°C

APPEARANCE: Light tan to gray opaque liquid

ODOR: Slight odor

pH: (aqueous 50/50) 8.45

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: Greater than 200°F, 93.3°C

METHOD USED: SCC

FLAMMABLE LIMITS:
LFL: Not applicable
UFL: Not applicable

AUTO-IGNITION TEMPERATURE: Not applicable

EXTINGUISHING MEDIA: SONAR A.S. is a water based suspension and will not burn. If product is involved in fire and water has evaporated, use water fog, CO2, dry chemical, or foam.

FIRE AND EXPLOSION HAZARDS: This product will not burn until a sufficient amount of water has evaporated. At this point, the product will exhibit the flammability characteristics of the organic portion of this formulation. Keep unnecessary people away; isolate hazard area and deny unnecessary entry. Highly toxic fumes are released in fire situations.

FIRE-FIGHTING EQUIPMENT: Wear positive-pressure, self-contained breathing apparatus and full protective equipment.

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) None known

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) None known

HAZARDOUS DECOMPOSITION PRODUCTS: If product is allowed to dry, will emit toxic vapors as it burns.

HAZARDOUS POLYMERIZATION: Does not occur.

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ENVIRONMENTAL DATA: Follow use directions carefully so as to avoid adverse effects on nontarget organisms. In order to avoid impact on threatened or endangered aquatic plant or animal species, users must consult their state fish and game agency or the U.S. Fish and Wildlife Service before making applications. Do not contaminate water when disposing of equipment washwaters. Trees and shrubs growing in water treated with Sonar A.S. may occasionally develop chlorosis. Do not apply in tidewater or brackish waters. Lowest rates should be used in shallow areas where the water depth is considerably less than the average depth of the entire treatment site, for example, shallow shoreline areas.

ACTION TO TAKE FOR SPILLS: Use absorbent material to contain and clean up small spills and dispose as waste. Large spills report to CHEMTREC and SePro Corporation for assistance. Prevent runoff.

DISPOSAL METHOD: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

6. HEALTH HAZARD DATA:

EYE: May cause slight transient (temporary) eye irritation. Corneal injury is unlikely.

SKIN CONTACT: Prolonged exposure may cause slight skin irritation. Did not cause allergic skin reactions when tested in guinea pigs.

SKIN ABSORPTION: A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. The LD50 for skin absorption in rabbits is greater than 2000 mg/kg.

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SePRO Corporation • Carmel, IN

INGESTION: Single dose oral toxicity is low. The oral LD50 for rats is greater than 500 mg/kg. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; swallowing amounts larger than that may cause injury.

INHALATION: At room temperature, vapors are minimal due to physical properties; a single exposure is not likely to be hazardous.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: In chronic toxicity studies in animals, fluridone has been shown to cause liver and kidney effects.

CANCER INFORMATION: The components did not cause cancer in long-term animal studies.

TERATOLOGY (BIRTH DEFECTS): In animal studies on some of the components (including fluridone), this product did not cause birth defects; for fluridone, other fetal effects occurred only at doses toxic to the mother.

MUTAGENICITY (EFFECTS ON GENETIC MATERIAL): For fluridone, results of mutagenicity tests in animals have been negative; results of a battery of in-vitro mutagenicity tests, except for one, have also been negative. Based on these results and the lack of carcinogenic response in long term studies, fluridone is not considered to be mutagenic.

7. FIRST AID:

EYES: Flush eyes with plenty of water. Get medical attention if irritation persists.

SKIN: Flush skin with plenty of water. Get medical attention if irritation persists.

INGESTION: Call a physician or poison control center. Drink one or two glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.

INHALATION: Move victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

8. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): Propylene glycol: AIHA WEEL is 50 ppm total, 10 mg/m3 aerosol only.

VENTILATION: Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline. If respiratory irritation is experienced, use an approved air-purifying respirator.

SKIN PROTECTION: For brief contact, no precautions other than clean body-covering clothing should be needed. Use chemically-resistant gloves when prolonged or frequently-repeated contact could occur. Wash thoroughly with soap and water after handling. Wash exposed clothing before reuse.

EYE PROTECTION: Use safety glasses.

9. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep out of reach of children. Harmful if swallowed, absorbed through skin, or if inhaled. Avoid breathing of spray mist or contact with skin, eyes, or clothing.

MSDS STATUS: Revised sections 1, 3, 5, 6, 7, 8, 9, and reg sheet.

REGULATORY INFORMATION:

(Not meant to be all-inclusive—selected regulations represented).

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

An immediate health hazard

TOXIC SUBSTANCES CONTROL ACT (TSCA): All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in Section 1 of the MSDS.

Material Safety Data Sheet

SePRO

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SONAR* A.S. Herbicide

SePRO Corporation • Carmel, IN

CHEMICAL NAME	CAS NUMBER	LIST
1,2-PROPANEDIOL	000057-55-6	PA1

PA1=Pennsylvania Hazardous Substance
(present at greater than or equal to 1.0%).

OSHA HAZARD COMMUNICATION STANDARD:
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

Category	Rating
Health	1
Flammability	0
Reactivity	0

The Information Herein Is Given In Good Faith,
But No Warranty, Express Or Implied, Is Made.
Consult SePRO Corporation For Further Information.

AQUATHOL® K
AQUATIC HERBICIDE

EMERGENCY TELEPHONE NUMBERS:
◆ (215) 419-5054 (7:30 a.m.-4 p.m. EST) (PRIMARY)
(800) 424-9300 (CHEMTREC)
(303) 623-5716 (Rocky Mountain Poison Control)

ADDRESS:
ELF ATOCHEM NORTH AMERICA, INC.
AGCHEM DIVISION
2000 MARKET ST., 21st FLOOR
PHILADELPHIA, PA 19103-3222

elf atochem
ATO

FORM 4627
REV. 7/96

MATERIAL SAFETY DATA SHEET

PRODUCT IDENTIFICATION

PRODUCT NAME
AQUATHOL® K AQUATIC HERBICIDE

EPA REG. NO.
4581-204

ELF ATOCHEM NORTH AMERICA, INC. CODE NUMBER
102

CHEMICAL NAME AND MOLECULAR FORMULA
DIPOTASSIUM ENDOTHALL
$C_8H_8O_5K_2$

SYNONYMS
DIPOTASSIUM 7-OXABICYCLO[2.2.1] HEPTANE-2,3-DICARBOXYLATE

CAS NUMBER OF ACTIVE INGREDIENT
2164-07-0

CHEMICAL FAMILY
DICARBOXYLIC ACID—DISALT

HAZARDOUS INGREDIENTS

◆ MATERIALS OR COMPONENTS	% WW
DIPOTASSIUM ENDOTHALL	40.3

Contains no substances known to be carcinogens.

SARA TITLE III

Hazards Classification (40 CFR 370):

Immediate Health: YES
Delayed Health: NO
Fire: NO
Sudden Pressure: NO
Reactivity: NO

Section 313 (40 CFR 372): This product contains the following chemicals subject to SARA Section 313 reporting requirements: Dipotassium endothall.

SHIPPING INFORMATION

PROPER SHIPPING DESCRIPTION
PESTICIDES, LIQUID, TOXIC, NOS (ENDOTHALL), 6.1, UN2902, PG III

◆ PLACARD
KEEP AWAY FROM FOOD

DOT RQ
1000 LBS.

PHYSICAL PROPERTIES

PHYSICAL STATE

BOILING POINT/RANGE
ca 100°C
ca. 212°F

MELTING POINT
NA

FREEZING POINT
–15°C 5°F

MOLECULAR WEIGHT (CALCULATED)
230.35

SPECIFIC GRAVITY (H_2O = 1)
1.285 (25/25°C)

◆ VAPOR PRESSURE (mm Hg)
NEGLIGIBLE

◆ VAPOR DENSITY (AIR = 1)
NE

◆ % VOLATILES BY VOLUME
59.7

EVAPORATION RATE
- ☐ ETHER = 1
- ☒ WATER = 1
- ☐ BUTYLACETATE = 1

◆ APPEARANCE AND ODOR
YELLOW BROWN LIQUID – VERY FAINT ODOR

FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD)
NA

FLAMMABLE LIMITS
NA

AUTOIGNITION TEMPERATURE/ FIRE POINT
NA

EXTINGUISHING MEDIA
- ☒ WATER SPRAY
- ☒ WATER FOG
- ☒ WATER STREAM
- ☒ CO_2
- ☒ DRY CHEMICAL
- ☐ ALCOHOL FOAM
- ☒ FOAM
- ☒ EARTH OR SAND

SPECIAL FIRE FIGHTING PROCEDURES
- ☐ DO NOT ENTER BUILDING
- ☐ ALLOW FIRE TO BURN
- ☐ WATER MAY CAUSE FROTHING
- ☐ DO NOT USE WATER
- ☒ OTHER: RESPIRATOR FOR ORGANIC ACIDS. PROVIDE EYE AND SKIN PROTECTION.

UNUSUAL FIRE AND EXPLOSION HAZARDS
- ☐ DUST EXPLOSION HAZARD
- ☐ SENSITIVE TO SHOCK
- ☐ CONTAMINATION
- ☐ TEMPERATURE
- ☒ OTHER: SEE DECOMPOSITION PRODUCTS BELOW

REACTIVITY DATA

STABILITY
☒ STABLE ☐ UNSTABLE

CONDITIONS CONTRIBUTING TO INSTABILITY
- ☒ THERMAL DECOMPOSITION
- ☐ PHOTO DEGRADATION
- ☐ POLYMERIZATION
- ☐ CONTAMINATION

REACTIVITY DATA, CONTINUED

INCOMPATIBILITY — AVOID CONTACT WITH
- ☐ STRONG ACIDS
- ☐ STRONG ALKALIS
- ☐ STRONG OXIDIZERS
- ☒ OTHER: MATERIALS THAT REACT WITH WATER

◆ HAZARDOUS DECOMPOSITION PRODUCTS, THERMAL AND OTHER:
Elevated temperatures convert endothall to anhydride, a strong vesiccant, causing blistering of eyes, mucous membranes and skin.

◆ CONDITIONS TO AVOID
- ☒ HEAT
- ☐ OPEN FLAMES
- ☐ SPARKS
- ☐ IGNITION SOURCES

SPILL OR LEAK

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
- ☒ 3 FLUSH WITH WATER
- ☒ 1 ABSORB WITH SAND OR INERT MATERIAL
- ☐ NEUTRALIZE
- ☒ 2 SWEEP OR SCOOP UP AND REMOVE
- ☐ KEEP UPWIND. EVACUATE ENCLOSED SPACES
- ☐ PREVENT SPREAD OR SPILL
- ☐ DISPOSE OF IMMEDIATELY

WASTE DISPOSAL METHOD:
If wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the hazardous waste representative at the nearest EPA Regional Office for guidance.

NA = NOT APPLICABLE
NE = NOT ESTABLISHED
◆ = SECTION REVISED

CONTINUED ON OTHER SIDE

ELF ATOCHEM NORTH AMERICA, INC.

PRODUCT NAME:
AQUATHOL® K AQUATIC HERBICIDE

CODE NUMBER:
102

MATERIAL SAFETY DATA SHEET

BEFORE USING PRODUCT, READ AND FOLLOW DIRECTIONS AND PRECAUTIONS ON PRODUCT LABEL AND BULLETINS.

TOXICITY

ORAL (ACUTE)
LD_{50} (RAT)—99.5 mg/kg

DERMAL (ACUTE)
LD_{50} (RABBIT)>2,000 mg/kg

INHALATION (ACUTE)
LC_{50} (RAT)—0.83 mg/L (4 HRS)

CHRONIC, SUBCHRONIC, ETC.
Based on a 1-year feeding study of disodium endothal to dogs, the NOEL is considered to be 150 ppm. Mice were dosed with disodium endothal in an 18-month oncogenicity study. The NOEL for this study is considered to be 100 ppm. There was no indication of carcinogenic effects. (1987, 1988)

HEALTH HAZARD INFORMATION

EFFECTS OF EXPOSURE TO CONCENTRATE

PERMISSIBLE EXPOSURE LIMIT (TLV/TWA OR CEILING [C])

ACGIH	TLV NE
OSHA	TWA NE

IRRITATION

- [x] SKIN
- [ ] SEVERE
- [ ] MODERATE
- [x] EYE
- [x] SEVERE
- [ ] MODERATE
- [ ] MILD (TRANSIENT)

CORROSIVITY

- [ ] SKIN
- [ ] 4 HRS. (DOT)
- [ ] 24 HRS. (CPSC)
- [x] EYE
- [ ] MAY CAUSE BLINDNESS

SENSITIZATION
NOT A SENSITIZER

INHALATION EFFECTS
NA

LUNG EFFECTS
SLIGHT TO MODERATE LUNG CONGESTION AND HEMORRHAGE UPON HEAVY OVEREXPOSURE

HEALTH HAZARD INFORMATION, CONTINUED

EMERGENCY FIRST AID

◆ INGESTION

- [x] GET MEDICAL ATTENTION
- [x] INDUCE VOMITING
- [x] *DO NOT* INDUCE VOMITING
- [x] GIVE PLENTY OF WATER
- [ ] OTHER:

NOTE TO PHYSICIAN: MEASURES AGAINST CIRCULATORY SHOCK. RESPIRATORY DEPRESSION, AND CONVULSION MAY BE NEEDED.

◆ DERMAL

- [x] GET MEDICAL ATTENTION
- [x] FLUSH WITH SOAP AND WATER
- [x] CONTAMINATED CLOTHING — REMOVE AND LAUNDER
- [ ] CONTAMINATED SHOES — DESTROY

EYE CONTACT

- [x] GET MEDICAL ATTENTION
- [x] FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES

◆ INHALATION

- [x] GET MEDICAL ATTENTION
- [x] REMOVE TO FRESH AIR
- [x] IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION
- [ ] GIVE OXYGEN

SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS —
ALWAYS MAINTAIN EXPOSURE BELOW PERMISSIBLE EXPOSURE LIMITS

- [ ] CONSULT AN INDUSTRIAL HYGIENIST OR ENVIRONMENTAL HEALTH SPECIALIST
- [ ] LOCAL EXHAUST
- [x] USE WITH ADEQUATE VENTILATION
- [ ] CHECK FOR AIR CONTAMINANT AND OXYGEN DEFICIENCY

◆ EYE

- [x] SAFETY GLASSES
- [x] FACE SHIELD
- [x] GOGGLES

◆ HAND (GLOVE TYPE)

- [x] POLYVINYL CHLORIDE
- [x] NEOPRENE
- [x] BUTYL RUBBER
- [x] NATURAL RUBBER
- [x] POLYVINYL ALCOHOL
- [x] POLYETHYLENE
- [x] ANY

RESPIRATOR TYPE —
NOT REQUIRED—USE NORMAL SAFETY PRECAUTIONS

◆ OTHER PROTECTIVE EQUIPMENT
WEAR PROTECTIVE CLOTHING TO PREVENT EYE AND SKIN CONTACT.

SPECIAL PRECAUTIONS

◆ PRECAUTIONARY LABELING

- [x] WASH THOROUGHLY AFTER HANDLING
- [x] DO NOT GET IN EYES, ON SKIN OR CLOTHING
- [x] DO NOT BREATHE DUST, VAPOR MIST, GAS
- [x] KEEP CONTAINER CLOSED
- [x] KEEP AWAY FROM HEAT SPARKS AND OPEN FLAMES
- [ ] STORE IN TIGHTLY CLOSED CONTAINERS
- [ ] DO NOT STORE NEAR COMBUSTIBLES
- [ ] KEEP FROM CONTACT WITH CLOTHING AND OTHER COMBUSTIBLE MATERIALS
- [x] EMPTY CONTAINER MAY CONTAIN HAZARDOUS RESIDUES
- [ ] USE EXPLOSION-PROOF EQUIPMENT

OTHER HANDLING AND STORAGE CONDITIONS
Store in the original container. Do not store in a manner where cross-contamination with other pesticides, fertilizers, food or feed could occur. Storage at temperatures below 32°F may result in the product crystallizing or freezing. Should this occur the product must be warmed to 50°F or higher and thoroughly agitated before using.

DATE: 7/96

ADDRESS:
ELF ATOCHEM NORTH AMERICA, INC.
AGCHEM DIVISION
2000 MARKET ST., 21st FLOOR
PHILADELPHIA, PA 19103-3222

PLEASE NOTE

APPENDIX C

RESPONSE TO PUBLIC COMMENT ON THE DRAFT PLAN

Public comments received on the Lake Wilderness IAPMP April 1997
Responses are italics

1) I am very impressed with the process for developing a IAPMP and the fact that King County has this capability as part of the Land Resources Division. In a county with as many lakes and wetlands as we have, I think this is an important part of maintaining the environmental quality for all of us.

No response required.

2) I agree with the recommendations of the Plan completely with one possible exception. It does not seem reasonable to me to plan to treat the plant problem at the south end of the lake with Aquathol to the tune of $90,000 over 10 years without including a provision to survey in year 1 and periodically thereafter the septic systems in use on all the properties that have lake frontage, and require and deficiencies to be corrected immediately. I don't believe you commented on it, but my assumption is that plant growth is accelerated by septic problems, and in any event the water quality is certainly impacted. I would not agree to participate in a Lake Management District assessment without this provision.

The analysis of on-site septic system contribution to lake nutrient concentration and any relationship to excessive aquatic plant growth was beyond the scope and funding of this project. We recommended to the steering committee that other lake management actions, including on-site septic system surveys should be considered for funding as they develop a funding strategy for the aquatic plant management plan.

3) Overall, the plan looks very good plan. To reiterate what I mentioned at the last meeting, some information on the EIS would be a good resource to the public. The Estimated Cost Table for 10-years give the interested citizens a long range perspective as to what they will see and expect in the future. This is good data for later decisions regarding the management of the lake.

Appendix C will include a reference to the State EIS, MSDAs, and fact sheets on Sonar and Aquathol.

4) On page 14 , the second paragraph, fifth line from the bottom, 'ever' be deleted.

No response required.

5) Cutting milfoil as a management tool should not be used because it encourages its spread.

Mechanical harvesting or had-cutting of Eurasian watermilfoil was not recommended in the plan. An aquatic herbicide will be used to eradicate the plant from the lake before proceeding with long-term management actions..